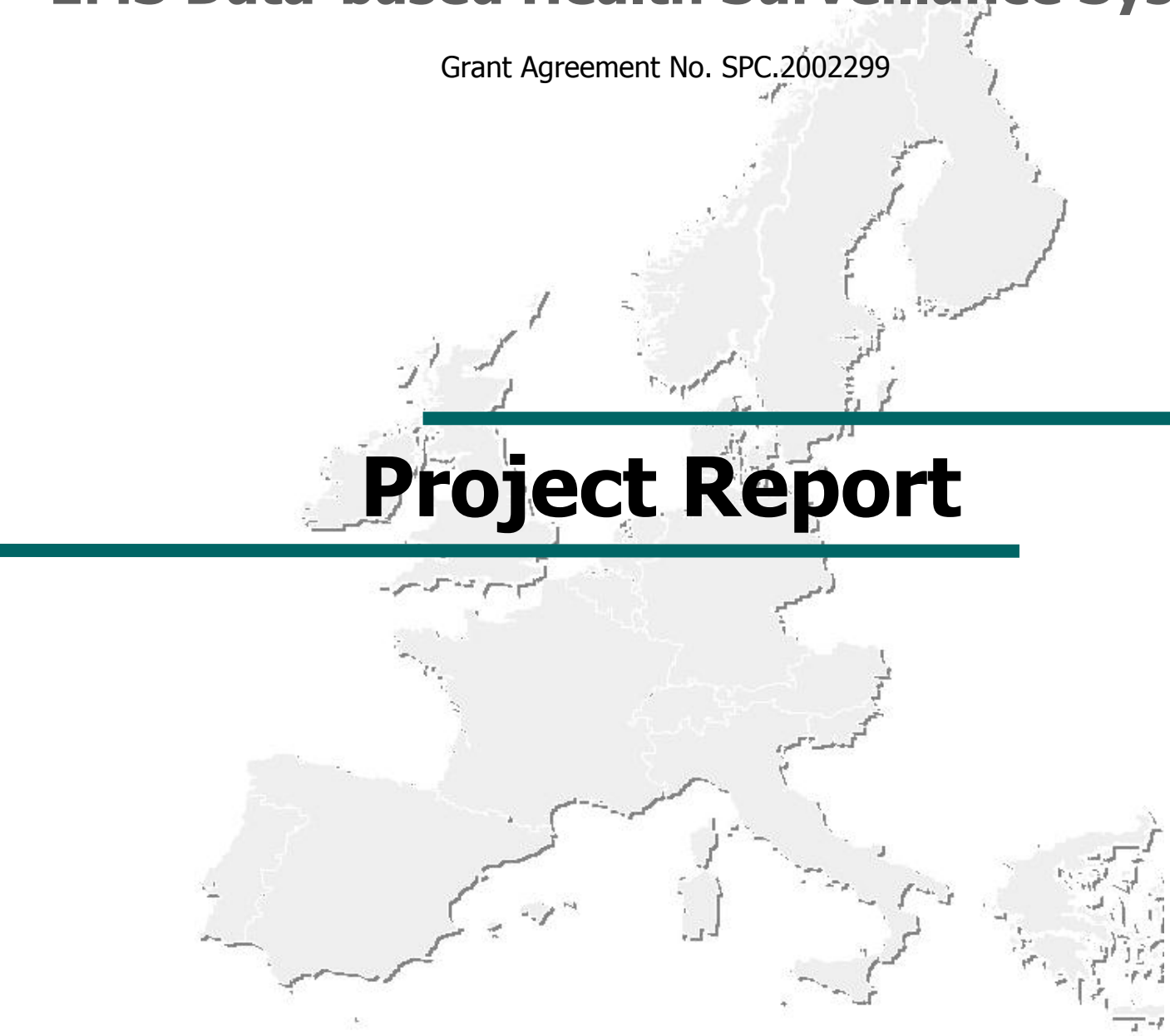
European Emergency Data Project

EMS Data-based Health Surveillance System

Grant Agreement No. SPC.2002299



Project Report

compiled and edited by
Thomas Krafft, Luis Garcia Castrillo Riesgo, Matthias Fischer, Iain Robertson-Steel, Freddy Lippert
on behalf of the EED project group

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Financed by the European Commission, Directorate-General Health and Consumer Protection, Directorate C Risk Assessment and Public Health, by Rheinische Friedrich-Wilhelms-University Bonn and Ludwig-Maximilians-Universität München

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Acknowledgements

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Executive Summary

Emergency Medical Services (EMS) is a unique component of health-care in the pre-hospital setting. It represents a unique source of epidemiological and health care information for public health monitoring that has been neglected in the past. The EED Project was designed to identify common indicators for European EMS systems and to evaluate their suitability for integration into a comprehensive public health monitoring strategy for the European Union (EU).

The development of EMS historically has been driven of localised forces, creating difficulties when it comes to comparing systems and developing common indicators for health monitoring and benchmarking. The result has been that there are numerous varieties of different types of EMS systems. While the science of patient treatment has advanced enormously, the logistics of patient-care delivery systems are divergent and under-researched.

Furthermore, equity of accessing the system differs. One problem is that the efforts to establish a common emergency number seem to have been less successful than anticipated. 112 has been introduced in most of the Member States, however, often as a second choice and not directly linked to the EMS system, causing considerable delay in emergency response.

The EMS systems have many features in common but there is no standard European system. The systems are delivered by a variety of providers and funded with different funding mechanisms. Organisation and logistics, particularly of dispatch, triage and prioritisation, are critically important and further development is necessary to achieve a standardised approach to EMS in the expanded EU. The variation and diversity of system designs is the main obstacle to comparing EMS systems. Comparative studies usually focus on one specific aspect of the system, such as staffing, costs or clinical outcomes. In contrast, a comprehensive comparison of the entire EMS system must include the tracking of the system's response to the patient' needs. Comprehensive system analysis provides an essential tool for identifying excellence and best practice in EMS for future recommendations on pan-European standards for EMS provision.

Throughout Europe, EMS data is recorded continuously including information about the patient's main complaints, age and sex, and the geographic location of emergency sites.
By including EMS data in a pan-European health monitoring system, information about the most serious diseases – including cardiovascular disorders, respiratory diseases and severe injuries (the "First Hour Quintet" = FHQ) – will be integrated into the Community's health surveillance strategy supporting the EU's efforts on injury prevention and health promotion.

The EED project was designed as a structured process for collecting and distilling knowledge from a group of experts by means of a series of workshops interspersed with controlled feed-

back from steering committee meetings. The process for developing the EED project and outcomes was effective in reaching a broad based consensus amongst multiple European partners and systems. The system of workshops, partner participation and steering committee guidance was perceived by all participants as effective and equitable.

As the principle result, there were five key indicators defined and recommended to be included in the European Community Health Indicators (ECHI) short list:

1. Unit hours ELS + BLS + ALS per 100,000 inhabitants (with 3 sub-indicators for ELS, BLS and ALS)
   → Indicator for Health System/ Resources
2. Response time (with 2 sub-indicators: 90% percentile and percentage ≤ 480 sec)
   → Indicator for Health System / Performance
3. Rate of highest priority responses per 100,000 inhabitants
   → Indicator for Health System/ Utilisation
4. Rate of FHQ diagnoses per 100,000 inhabitants (with 5 sub-indicators: cardiac arrest incidents, severe trauma incidents, severe breathing difficulties, cardiac chest pain incidents and stroke incidents)
   → Indicator for Health Status / Mortality; Morbidity
5. Rate of ALS interventions per 100,000 inhabitants (with 3 sub-indicators: assisted ventilation, intubation and iv drug administration)
   → Indicator for Health System/ Performance

Additional indicators that can be applied universally were identified as future recommendations. An outstanding example of a clearly identified, defined and essential indicator is "Time to First Shock". It marks the interval between collapse after cardiac arrest and application of the first defibrillatory shock in patients suffering from ventricular fibrillation. The time period determines the chances of good neurological recovery and/or survival after cardiac arrest and is therefore considered to be one of the most crucial indicators for EMS performance. The pilot study revealed significant limitations regarding availability and comparability of this key indicator, so it was not included in the list of recommended EMS key indicators.

Unless there is a focus on prevention and public health for FHQ conditions, EMS demand will rise due to demographics and morbidity and the health-care burden will increase. A European declaration of emergency care rights needs to be made and supported by a template for minimum standards for a European EMS system.

1 Introduction

Emergency Medical Services (EMS) is a unique component of health-care in the pre-hospital setting. EMS data within the pre-hospital setting represents a unique source of epidemiological and health care information[2] for public health monitoring that has been neglected in the past. The European Emergency Data (EED) Project was designed to identify common indicators for European EMS systems and to evaluate their suitability for integration into a comprehensive public health monitoring strategy for the European Union (EU). The project was co-funded by the European Commission (Grant Agreement No. SPC.2002299) and the Universities of Bonn (Rheinische Friedrich-Wilhelms-Universität - RFWU) and Munich (Ludwig-Maximilians-Universität - LMU) in Germany.

Comment: While the science of patient treatment has advanced enormously, the logistics of patient-care delivery systems are divergent and under-researched. The organisation and delivery of care represents a large logistical problem. Providing solutions to this problem represent the greatest challenge in improving survival and reducing morbidity and mortality.

[2] Hsiao, Hedges 1993

1.1 The European Community Health Monitoring Programme 1997-2002

In their editorial to a special issue of EJPH on health monitoring in Europe MCKEE and RYAN characterised the European Health Monitoring Programme as follows:

"The modern world has, at its heart, a strange paradox. In surveys, individuals invariably place good health at the top of their list of priorities; however, as societies we expend remarkably little effort in assessing whether we are achieving this goal or not. At present, the health needs of millions of European citizens are effectively invisible. It was to remedy this situation that the Community Action Programme on Health Monitoring was established in 1997."[3]

The objective of the European Commission's Community Action Programme on Health Monitoring was to contribute to the establishment of a consistent, permanent and coherent European Community health monitoring system to accomplish the following:

- Measure health status, trends and determinants throughout the Community
- Facilitate the planning, monitoring and evaluation of Community programmes and actions, and
- Provide Member States with appropriate health information to make comparisons and support their national health policies.

The programme was structured according to the following three pillars, each addressing various aspects of health monitoring:

- Pillar A — establish Community health indicators
- Pillar B — develop a Community-wide network for the sharing and transfer of health data between Member States, the Commission and international organisations
- Pillar C — develop the methods and tools necessary for analysis and reporting, and the support of analyses and reporting, on health status, trends and determinants and on the effect of health policies.

These pillars supported a variety of projects covering a range of health-care specialties, from in-patient to outpatient care. Pre-hospital emergency care, or EMS, was not included in the original programme.

The EED project was developed to bridge this gap and to support the use of EMS data in the public health monitoring programme, using the following methodologies:

a) Identify common data routinely collected throughout European EMS systems, and

b) Test the applicability of these data for health monitoring.

[3] McKee, Ryan 2003

1.2 Relevance of EMS for Health Monitoring

EMS care has to focus on acute and chronic medical conditions in which rapid response and earliest possible treatment can modify patient outcome significantly.

1.2.1 The First Hour Quintet

The European Resuscitation Council has identified five conditions in which EMS systems can play a crucial role.[4] This "First Hour Quintet" consists of the following:

- Cardiac arrest
- Severe respiratory difficulties
- Severe trauma
- Chest pain, including ACS and
- stroke.

The common characteristics of this group of commonly occurring diseases are the need for rapid evaluation and treatment and, specifically, the need to begin care in the pre-hospital setting and to transport the patient to a definitive care service. For a list of indications (ICD codes) that are part of the First Hour Quintet see Appendix 7: First Hour Quintet.

Together these conditions are among the four leading causes of death in the EU. EMS is a vital part of the care process, providing the critical early links in the chain of survival.

[4] cf. presentations and discussions during the 6th European Resuscitation Council, Florence 2002

1.2.2 Main burden of disease relevant to emergency medical care

The leading causes of death and morbidity are similar through the industrialised western world, with cardiovascular problems, cancer, external causes and respiratory diseases representing the top four. 80% of all deaths are attributable to these common causes. [5]

Each of these conditions occurs at different points in a person's life span. In the EU, for example, external causes are the principal cause of death in individuals aged five years to 24 years, and generate the same number of years of life lost to early death as Coronary Heart Disease. Cancer is the predominant cause of death in individuals aged 24 years to 74 years, while Cardiovascular Disease (CVD) is the main cause of death for people aged 75 and up, followed by cancer. While this ranking is broadly uniform in all EU countries, there are several factors modifying the rates adjusted per population, which produce geographical differences. These factors include: gender, genetics, Socio-economic Status (SES), and environmental factors.

Of the four main causes of death, cardiovascular problems, respiratory disease and external causes are typically time-dependent events in which EMS plays a fundamental role by providing rapid access to the health system, quality care on

[5] cf. WHO 2004

scene, and selective transport with support en route to definitive care if it has not been provided on scene.

1.2.2.1 Cardiovascular Disease

CVD is the number-one cause of death in all EU countries, resulting in 4 million deaths per year in Europe or 1.5 million in the EU respectively. CVD also accounts for the largest amount of years of life lost by early death in Europe and in the EU, contributing significantly to the escalating costs of health care. [6]

There is variation in these figures between countries, with France identifying a rate of 240 deaths per 100,000 inhabitants per year in males and 140 in females, to Ireland with 515 deaths in males and 309 in females.

Coronary Heart Disease (CHD) is the most important cause of death in the adult population, constituting 55% of all CVD deaths. These deaths are age-related and are more common in males, accounting for 18% of all male deaths and 15% of females. Relevant variations across countries in the EU for males and females are observed (cf. Map 1).

Acute coronary syndromes (ACS) include Acute Myocardial Infarction (AMI), Unstable Angina and Sudden Cardiac Death. This diagnostic group represents the most severe forms of CHD. With this group, rapid access to the health system and prompt definitive care are vital.

The World Health Organization's (WHO) MONICA Project has demonstrated that there is great inter-country variability in the rate of coronary events, with the highest rate for men occurring in Finland with 835 per 100,000 individuals, and the highest rate for women occurring in the United Kingdom (Scotland) with 265. The lowest rate for women occurs in Spain (Catalonia), with 35 events per 100,000.

Mortality from ACS is extremely common outside the hospital, with 52% of deaths occurring before the patient reaches the hospital.

The incidence of Sudden Cardiac Death (SCD) as a manifestation of CHD is difficult to estimate; between 0.36 to 1.28 individuals per 1,000 suffer SCD as a result of CHD per year, the majority of which occur in the pre-hospital or out-of-hospital setting. The first recorded rhythm in 75% to 80% of these patients is Ventricular Fibrillation (VF), a potentially reversible arrhythmia if immediate treatment by defibrillation is provided. The proven ability to resuscitate patients in SCD, and the fact that 2/3 of all CHD deaths occur in the community, clearly demonstrate the importance of EMS and the pre-hospital delivery of care. [7,8]

[6] cf. WHO 2004

[7] Becker, Smith, Rhodes 1993

[8] Priori et al. 2001

Trends

Though CVD mortality and incidence are falling in some countries, the number of patients admitted to hospitals with a confirmed diagnosis of cardiovascular system problems, especially with CHD, is increasing in all countries.

As an age-related disease in an aging EU population, an increase in workload on the health system is expected. This increase will be further exacerbated by the incorporation of new EU members with higher incidence and mortality rate from CHD.

Rationale

Primary and secondary prevention is the logical approach to managing CHD. ACS, including Acute Myocardial Infarction (AMI), Unstable Angina (UA) and SCD are time-dependent diseases in which any delay in the delivery of the acute-phase treatment may result in a significant negative impact on survival and outcome. Rapid access to a health system providing early assessment, pain management, control of arrhythmias, especially VF and early revascularisation, are the core elements of treatment, improving survival. EMS is the key element in the chain of care as reflected in scientific guidelines and integrated care pathways for CHD. [9,10,11]

1.2.2.2 Stroke

Stroke is an age- and gender-dependent disease, with mortality rates higher in males. In the EU it is the third cause of death, after CHD and cancer, with a million new cases, and 400,000 fatalities per year.

The adjusted mortality rate for stroke reflects a geographical variability with a north-south and east-west gradient in Europe, potentially reflecting different genetic and environmental factors (cf. Map 1). Mortality rates from stroke are lowest in France, with 20.6 deaths due to stroke per 100,000 inhabitants in females, rising to 119.4 deaths per 100,000 inhabitants in Portugal for males. The incidence of stroke follows a similar pattern, with 270 new cases per 100,000 inhabitants per year in Finland and 100 new cases in Italy.

Stroke is also the leading cause of disability in industrialised societies, contributing 6.9% of the total years of life lost and producing an estimated 5% of the total health care costs in England and 6% in Finland.[12,13]

Trends

With more than 15% of the EU population age 64 years and up, stroke as an age-related disease will increase the burden

[9] American Heart Association in collaboration with International Liasion Committee on Resuscitation 2000

[10] Ministerio de Sanidad y Consumo, Secretaria General de Sanidad
Agencia de Calidad del Sistema Nacional de Salud 2003

[11] No author 2000

[12] *Bonita 1992*

[13] Thorvaldsen, Asplund, Kuulasmaa for The Who Monica Project 1995

on the health-care system. [14,15] Morbidity in this age group is increasing, as reflected in the number of stroke patients discharged from hospital to the community.

The incorporation of new EU members with higher incidence and mortality rate from CVD and specifically from stroke will generate an increasing workload for health care systems.

Rationale

An important change in treatment of stroke patients has taken place in recent years. There has been a trend towards the replacement of passive management regimes with active management of the event, including revascularisation. The scientific evidence demonstrates that early active care produces a positive impact on outcome. While many similarities are observed with CHD patients, minimum time to definitive care is the key element in the process. EMS in combination with dedicated stroke units are recognised as a fundamental part of CHD and stroke care. Rapid access to care is highlighted in all the relevant scientific guidelines. [16,17]

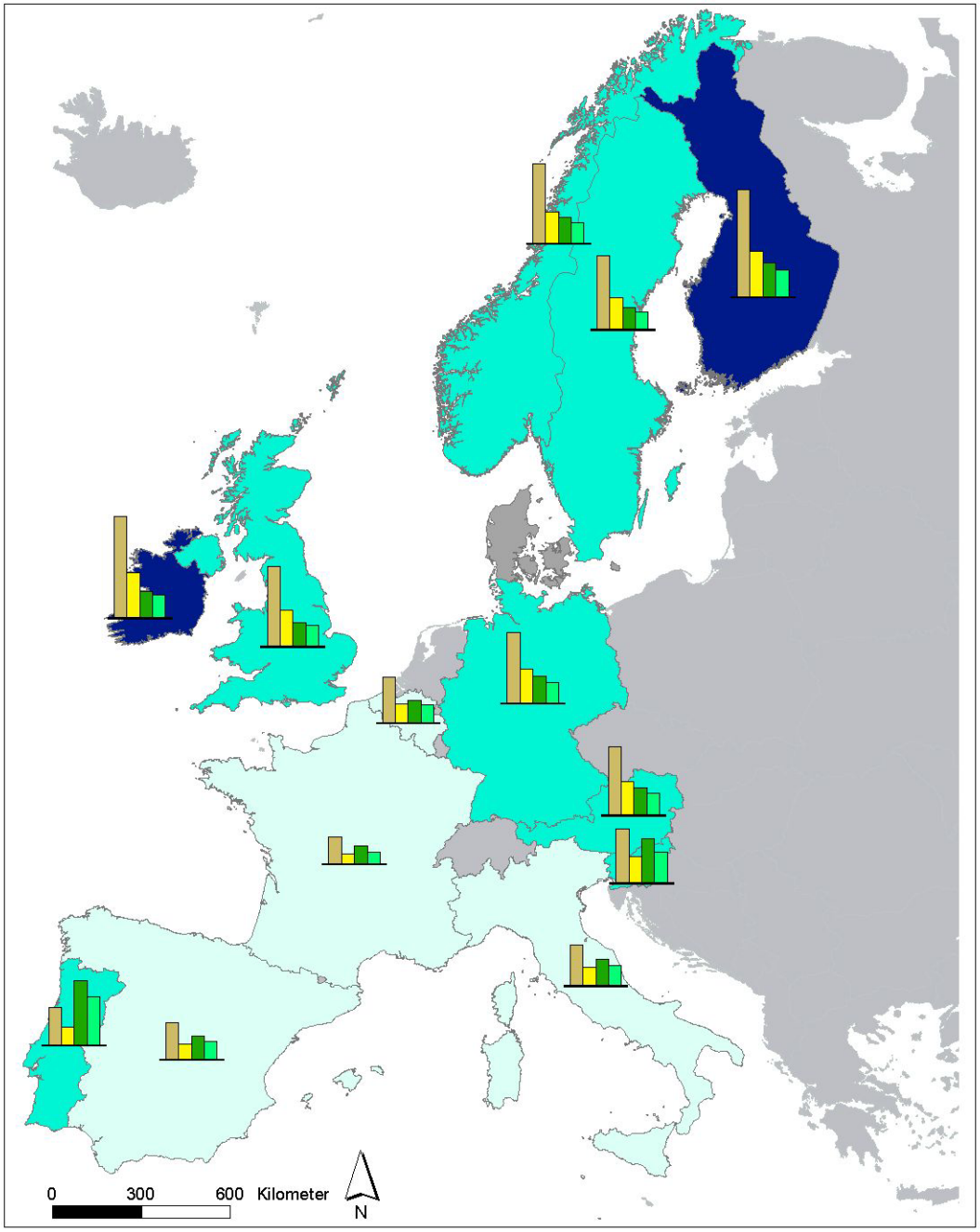
Differences in outcome by country reflect the different levels of care provision, as well as access to health care and treatment within the different countries. EMS is a critical part of the development of improved care.

[14] World Health Organization. http://www.who.int/whosis/

[15] Global Cardiovascular Info Base. http://www.cvdinfobase.ca/

[16] Hacke et al. 2000

[17] American Heart Association in collaboration with International Liasion Committee on Resuscitation 2000



Source of data: WHO Library Cataloguing in Publication Dat. Atlas of health in Europe. ISBN 92 890 1370 2 (NLM Classification: WA 17); http:// cvd infobase.ca ; Basemap: Environmental Systems Resaerch Institut ; Mapping and Layout: GEOMED 2004

Map 1: Coronary Heart Disease and Stroke prevalence by sex per 100.000 populations in Europe

1.2.2.3 External Causes

External causes, such as trauma from violence or accidents and poisoning, are a significant cause of death in younger members of the EU population. Injuries, mainly traffic accidents, are the leading cause of death in the under-25 age group, resulting in the same number of years of life lost as CHD.

EMS plays a substantial role in delivering trauma care. From the early years of EMS, the concept of the "Golden Hour" derived from the mortality distribution in injury patients. There is a tri-modal distribution of mortality in trauma, identified as follows: 1) an immediate mortality occurring on scene, due to severe injuries, with little possibility of increasing survival; 2) a second peak of mortality, which occurs in the first hours after the incident and results from the poor management of treatable problems. Many of these problems could be avoided by improvements in trauma care delivery within the "Golden Hour"; 3) A late peak in deaths that occurs days to weeks after to the event as a result of organ failure, infection and in-hospital problems.

The role of EMS in the management of critically injured patients and in mass casualty incidents or catastrophes is crucial. The integration of EMS in a trauma system has demonstrated the possibility of improving outcome in severely injured patients by focusing on avoidable problems and ensuring that patients are transported to designated specialist centres for definitive care.

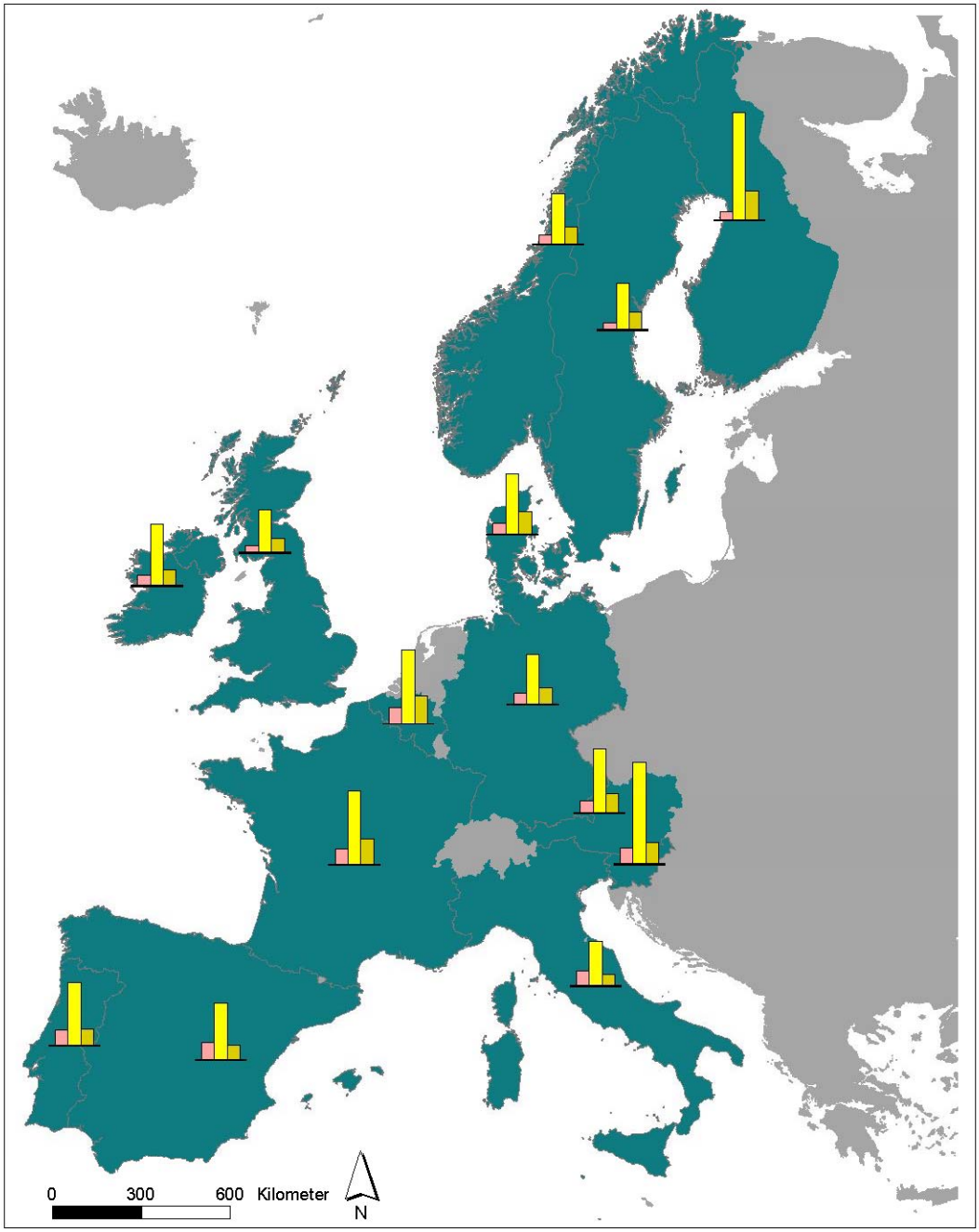
Trends

While the Northern countries have reduced the rate of traffic accidents, the Mediterranean area continues to have an accident rate three times higher. Overall, the total number of road accidents in the EU countries has been decreasing over the last 14 years (-10.2%), despite the increase recorded in traffic volume. However, an opposite trend has been observed in Greece, Ireland, Spain and Portugal. New EU members have higher incidence and mortality rates.

Rationale

The classic distribution of death after an accident, with 30% of the deaths occurring in the first two hours due to problems such as airway obstruction, respiratory failure or haemorrhagic shock, reflects the relevant role of on-scene treatment. There is also the enormous potential for a positive impact on outcomes from this on-scene care, as a variety of these conditions can be controlled by simple interventions. These assumptions justify and explain the improvements in outcome that the implementation of an EMS system produces for trauma patients. [18]

[18] Nathens et al. 2000



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Map 2: Traffic related injuries and external causes prevalence by sex per 100.000 populations in Europe

1.2.2.4 Respiratory diseases

Acute respiratory problems, such as asthma, respiratory infections and decompensation of chronic respiratory patients, are among the leading cause of death in the EU. Acute respiratory problems are related to several factors including environmental and socio-demographic conditions.

Acute infectious respiratory problems, such as pneumonia or influenza, account for 3% of all deaths in males and 4% for females in EU states (cf. Map 3). Chronic respiratory problems, such as asthma or Chronic Obstructive Pulmonary Disease (COPD) account for 4 % of all deaths in males and 2.6% of all female deaths. COPD is responsible for 30% of all respiratory deaths. [19,20]

Trends

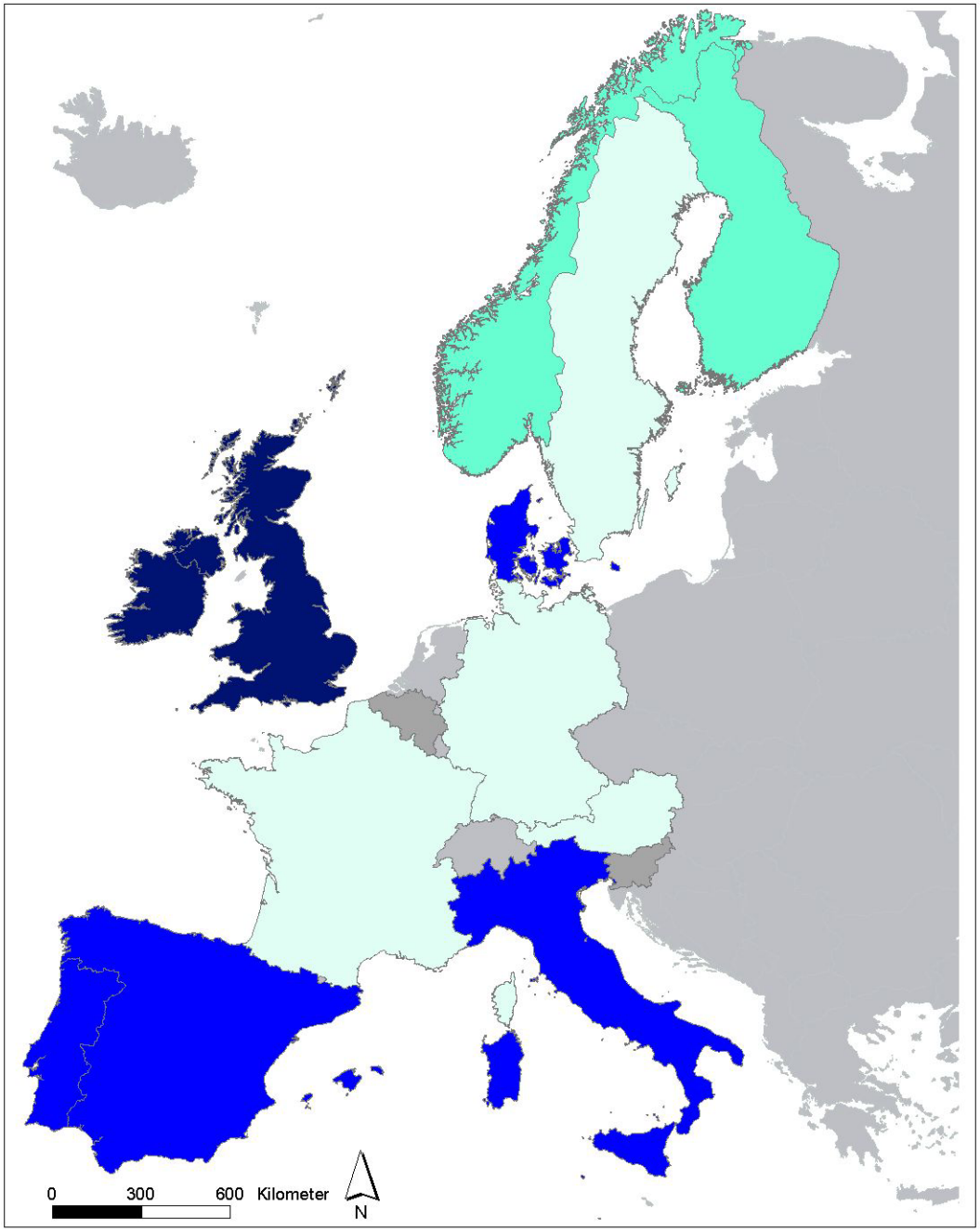
Generally, there is a downward trend in respiratory disease in all parts of the EU. The 1970s and 1980s saw a clear reduction in respiratory rate, but the rate has not changed significantly since that time.

Rationale

The role of EMS in providing care to respiratory patients is relevant not only in that it allows for the provision of vital support in cases of respiratory failure, but also that it delivers medical treatments reversing broncho-constriction and providing adequate oxygen. These procedures produce a rapid improvement of symptoms in the initial phase, and in some cases can be a source of definitive care.

[19] World Health Organization. http://www.who.int/whosis/

[20] Nathens et al. 2000



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Map 3: Respiratory diseases prevalence by sex per 100.000 populations in Europe

1.2.3 Emergency Medical Services: An international system perspective

Pre-hospital EMS systems are commonly understood as the resources used for planning, providing and monitoring medical care for patients who experience an unpredicted need for emergency or urgent medical care outside a hospital or other medical facility. The EMS system's primary role is to provide care for patients whose lives are at immediate or imminent risk. While there is a great variety in EMS system design throughout Europe, the major components of their procedures, information gathering and data collection have similar objectives.

Traditionally, EMS was not considered a part of the health-care delivery system. EMS evolved from the need to transport a patient from a scene, specifically during military conflicts, to a physician who could provide definitive care. The delivery of emergency care in the past often was done on a local basis and was typically dependent on volunteers and/or skilled staff in religious orders.

Over time, individual communities developed a medical transport mode that best met the needs of that community, based on human factors such as culture, existing health-care resources, and financial pressures. The recognition that medical help before and during transport, or even the transport itself, could positively impact patient outcome, and that it was part of a "system" was not recognised until the 1960s, long after ambulance transport was an established part of the communities' infrastructure. The direct result is the diversity of EMS systems found internationally.

Some EMS systems are based on the provision of pre-hospital care by medically trained non-physicians (emergency medical technicians and paramedics), while others are built around the central role of emergency physicians attending emergency patients at the scene. Accordingly, some EMS systems tend to provide as much care as possible at the emergency scene, while others prioritise the minimization of on-scene and transport time. Despite the many regional or local variations ranging from equipment to communications or training standards, certain commonalities for all systems have emerged, even among those operating under different legal frameworks.

Organised systems that provide care for the acutely ill and injured are now in place in all EU Member States. EMS is part of a spectrum of care, along with family practice, elective care and access to advice for self-care. EMS has always been focused on the delivery of care to life-threatening emergencies.

European citizens now expect prompt access to care for an unexpected medical or traumatic emergency, at any time. This expectation applies regardless of age and location. There is a need to separate this

expectation from the actual needs of the public.

Emergency medical systems must be organised to provide a response around the clock. Organisation in these systems must be structured differently in urban, semi-urban and rural areas. They must have appropriate alerting and responding systems, and the ability to deliver patients to definitive care in the minimum time. EMS systems need to define their treatment and transport roles; the concept of minimum time to delivery of care is applied differently, depending on the journey time to centres for definitive care and whether the patient is ill or injured.

The provision of organised prioritisation and dispatching systems and procedures is the crucial first step in the delivery of any emergency medical support. Dispatch procedures have an important gatekeeper role in sorting, streaming and directing resources. While dispatch centres may take a wide range of calls, it is vitally important that they be able to differentiate calls into categories, including Immediately Life-Threatening, Urgent and Non Life-Threatening, and have the ability to pass non-urgent minor illness and minor injury calls to alternative resources such as General Practice or Minor Injury and Minor Illness Centres. This allows them to avoid degrading the responsiveness of the resource-limited system.

Throughout Europe, it would be reasonable to suggest that all citizens should have access to organised Basic Life Support (BLS) provided by their community as a minimum standard. BLS, as defined by the European Resuscitation Council in 2002[21], is the ability to deliver cardio-pulmonary resuscitation (CPR) and to provide a defibrillator to treat ventricular fibrillation in cardiac emergencies.

BLS needs to be underpinned by the knowledge and the ability of first responder to carry out Emergency Life Support (ELS) on the citizens of the Community to bridge the time gap until a BLS provider arrives on scene.

The ideal standard for any EMS system is to aim towards the capability to provide early Advanced Life Support (ALS) and Advanced Trauma Life Support.[22]

The Quintet conditions, – as defined by the European Resuscitation Council -, require the early delivery of ALS skills.

[21] Handley, Monsieurs, Bossaert 2001

[22] Latorre de et al. 2001

Principles for European Emergency Medical Systems

To function effectively, EMS systems must operate in the following way:

1. Must provide immediate and straightforward access, with equity.
2. Triage systems must be sensitive and specific to maximise the use of resources.
3. Must treat the sickest people first by using a unified prioritisation system to generate the most appropriate response, and they must be able to focus on emergency care.
4. To minimise morbidity and mortality, must operate on the principle of minimum time to definitive care and deliver effective and skilled personnel to the patient, passing the baton of care on the minimum number of occasions.
5. Systems must clearly identify their roles in the health-care spectrum, clearly differentiating between taking intensive care to the patient *or* providing immediate care followed by rapid transport to a definitive-care centre; the most effective transport and response systems must be operational to cope with the needs in urban, semi-urban and rural areas.

1.3 State of Knowledge

It is well documented that the timeliness and quality of care provided by the EMS system significantly influences patient outcome[23,2425], as differences in survival of out-of-hospital cardiac arrest patients all over Europe[26,27] may be explained by medical performance or system design. For example, the provision of BLS care by volunteers to full ALS care by emergency physicians can have a significant impact on health outcomes and on health economy (e. g. hospital admission rates, length of stay, etc.)[28]. However, only a few studies have attempted to systematically address this problem so far.

In North America, initial benchmarking studies have been undertaken to compare the clinical and economical performance of different EMS systems. Though only focused on comparable North American EMS systems, these studies laid the methodological groundwork for further studies linking medical outcome and economic performance[29].

One of the first attempts to systematically compare the clinical and economic performance of different EMS systems in Europe was a project comparing systems in Santander (Spain), Bonn (Germany) and Birmingham (UK). The study was based on a comprehensive framework for system analysis (cf. Figure 1) using standardised scores and measurements like the ICD coding system, the Glasgow Coma Scale (GCS), the Mainz Emergency Evaluation Score (MEES) and outcome scores.

Based on these variables, the process of health-care delivery given by EMS was evaluated using both the clinical and economic performance[30].

The study proved that international comparison and benchmarking of different EMS systems is possible and useful. The results also highlighted the relevance of emergency data for public health monitoring (cf. Map 4)[31] and for analysing socio-demographic and socio-economic determinants on health-care utilisation (cf. Map 5)[32]. The study further highlighted the need for further research on system design, and management economics and effectiveness to answer crucial questions being raised by legislators, medical professionals and EMS managers as they mandate and develop the European EMS System of the future.

These earlier results form the scientific basis for the EED Project – An EMS Data-based Health Surveillance System.

[23] Dagher, Lloyd 1992

[24] Eisenberg et al. 1990

[25] Sayre et al. 2004

[26] Herlitz et al. 1999

[27] Fischer, M. et al. 2003

[28] Edwards, Robertson-Steel, Johns 2002

[29] Overton 2002

[30] Krafft et al. 2000

[31] Krafft et al. 2002

[32] Braun et al. 2002

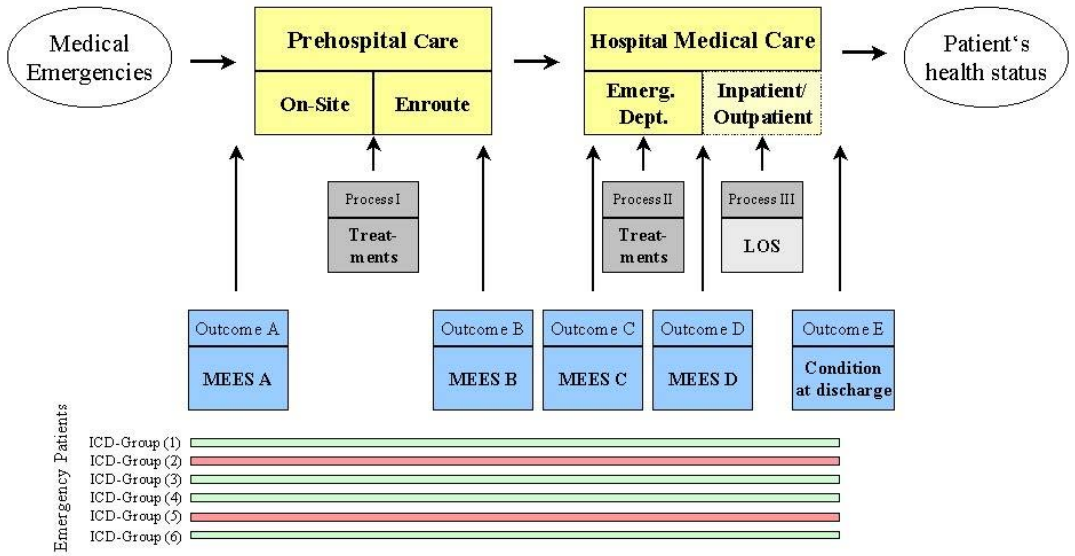
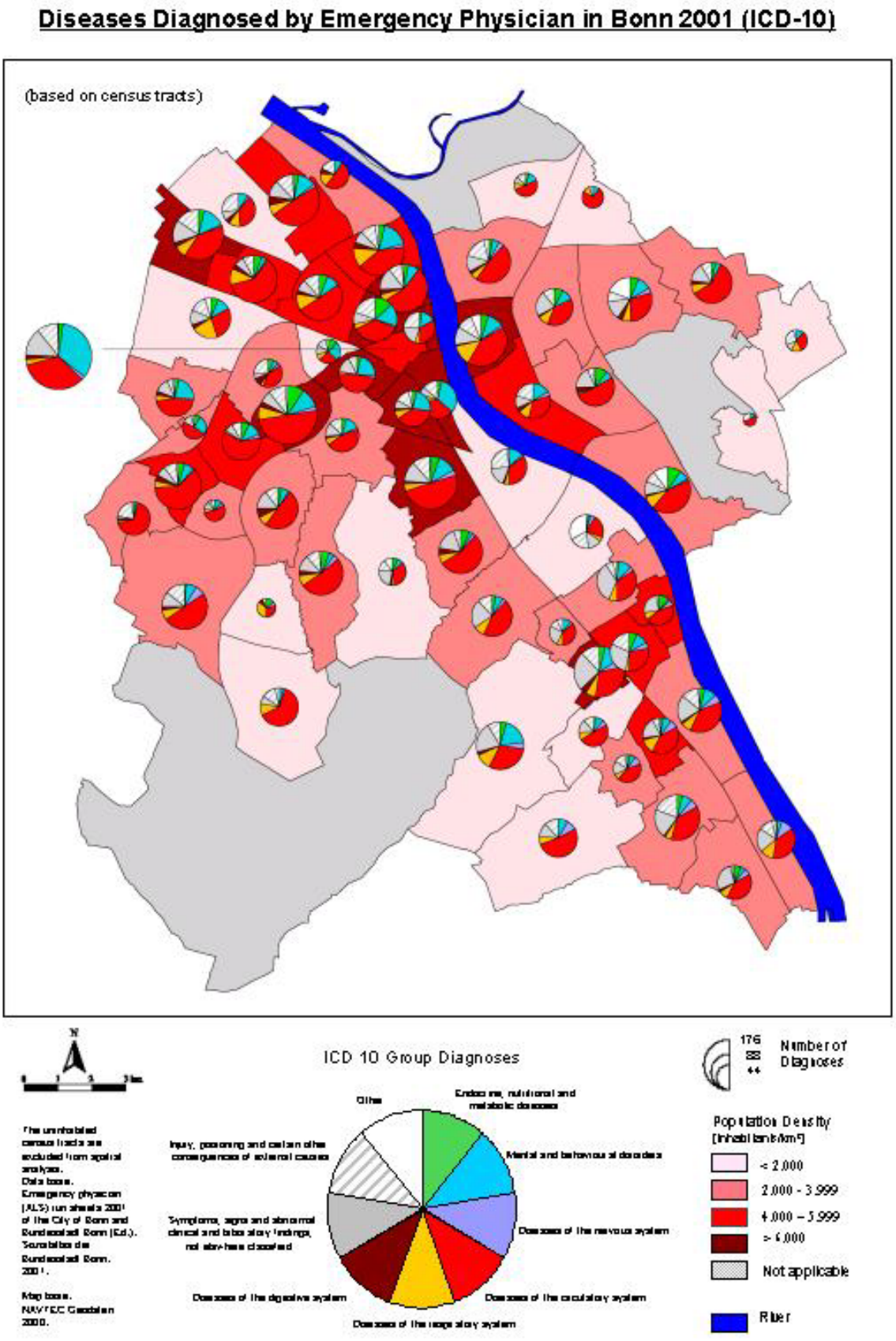
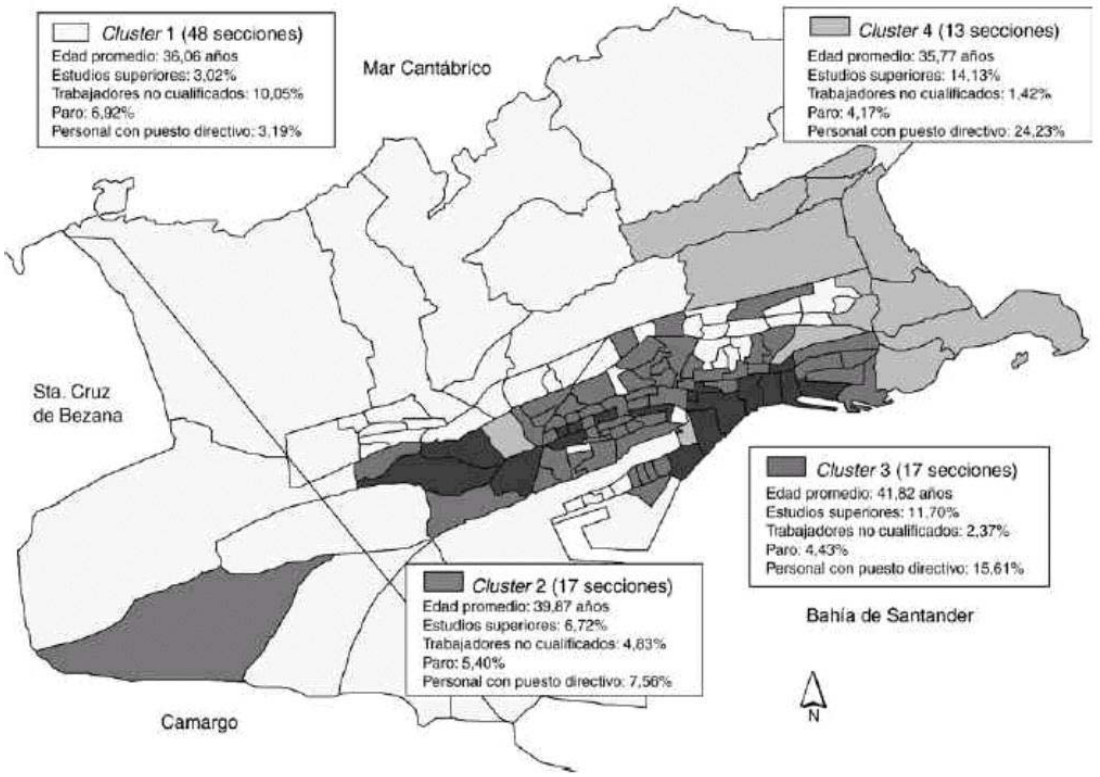


Figure 1: The framework for analysis of EMS systems



Map 4: Diseases diagnosed by emergency physician in Bonn 2001 (ICD 10)



Map 5: Socio-spatial analysis of Cantabria/Spain

2 Objective of the EED project

The principle objective of the EED project was to identify common components and indicators of EMS systems and create a common framework for monitoring and assessing EMS systems throughout the EU as an integral part of a public-health monitoring strategy. This led to the development of key indicators from evidence-based data that allowed further comparisons among different Member States.

The project provided a methodological approach for the creation of indicators based on the collection of EMS data that enabled the monitoring, evaluation and comparison of the respective activities of the Member States in the area of pre-hospital emergency care. As part of this objective, EMS data was analysed to identify its applicability to provide essential information on the temporal and geographical distribution of accidents and critical medical conditions.

3 The EED project methodology

To achieve the objective, the EED project was designed as a structured process for collecting and distilling knowledge from a group of experts by means of a series of workshops interspersed with controlled feedback from steering committee meetings.

Key elements of the process included:

- Structuring of information flow,
- Providing feedback to the participating institutions and
- Reaching consensus among participants.

The first step in this process was to identify common elements through the use of a standardised format for following the patient's pathway through any emergency medical system.

In the second step, the expert panel followed an iterative process to identify common data points and definitions, building a basis for identifying relevant EMS indicators.

In the third step, a pilot study was performed to test the ability of the participating systems to provide sound and reliable data for the proposed EMS indicators.

Fourthly, the expert panel and the steering committee refined the proposed EMS indicators (= master list of all proposed indicators) to five key indicators using the following criteria:

- Availability as routine data,
- Reliability,
- Comparability,
- Relevance for health monitoring and Uniqueness.

3.1 Steering Committee

The project was co-ordinated by a steering committee consisting of a group of experienced senior clinicians and scientists from multiple disciplines, and EMS managers (cf. Appendix 2: Members of the steering committee).

3.2 Selection of partners

Project partners were selected using the following four criteria:

- Knowledge of local and national systems & experience in data collection and aggregation,
- Representation of diverse system designs,
- Representation of functional and recognisable systems and
- Representation of systems from a maximum number of the European Member States.

All members are listed in Appendix 1: Participants).

3.3 Workshop activities

Clearly defined aims were established for each workshop (cf. Appendix 8: Workshops), and results were obtained and collated using established methodology. The information was then reviewed by the steering committee and provided back to the partners.

Figure 2 provides the timeframe from the initiation of the project to its conclusion.

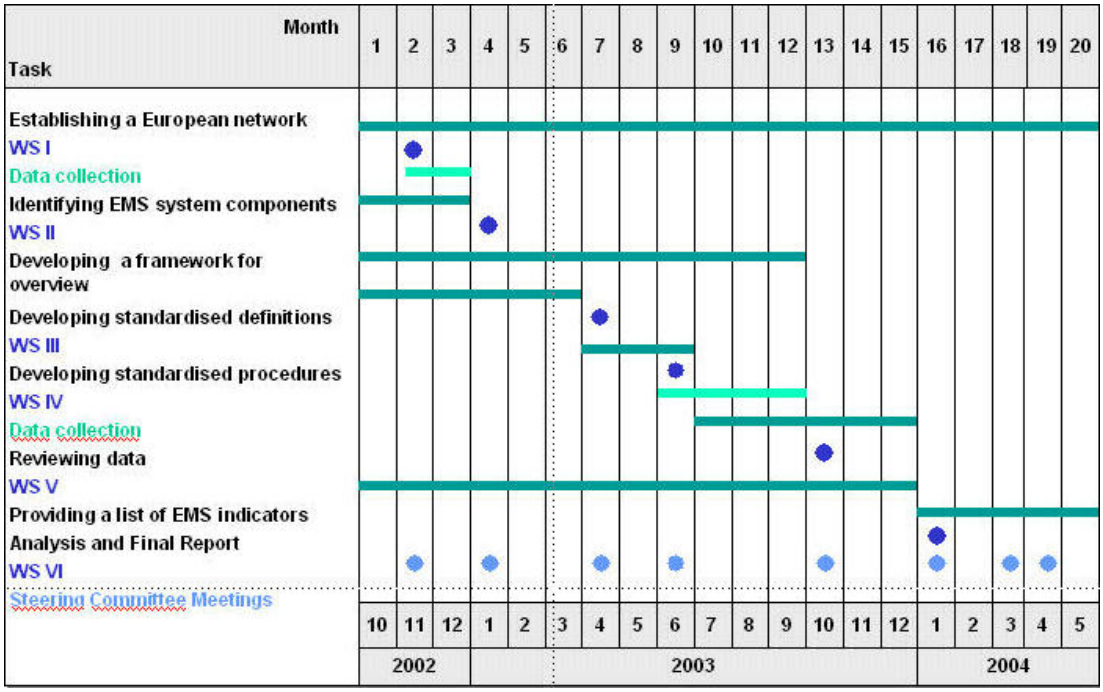


Figure 2: Timeframe of the EED project

3.4 Pilot data collection

A pilot study was conducted once the group reached final agreement on the master list of indicators and a methodology for collection and on analysis. Data to validate the established indicators was collected prospectively for one sample month (June 2003) by each participating system. If the information was already available on an annual basis, this data was also provided. The data was analysed according to the above-defined criteria.

3.5 Dissemination strategy

The project group jointly adopted a dissemination strategy at the last project workshop in Kramsach, Austria (January 22nd – 23rd, 2004).

The dissemination plan comprises a three-fold strategy addressing the following audiences/target groups:

- International: clinicians and scientists (target group A)
- National: professionals and scientific societies (target group B)
- National & regional: stakeholders and health authorities (target group C)

On approval of the final report by the European Commission, copies will be distributed to national and regional target groups in co-operation with our respective partners in the project.

Several ways of disseminating the results have been used, including presentations at conferences and publications in journals that are listed in Appendix 9: Dissemination.

Website

To facilitate the communication between the members of the project and to disseminate the results, a website (**http://www.eed-project.de**) was started in May 2003 and contains results, presentations and publications. The website also was used as a platform for data collection, with different systems providing data through an online form during the pilot study and for the benchmarking survey. The website will be used in the future as a platform for networking, information sharing and communication.

4 Findings

The EED Project was designed to contribute to the European Community's interest in monitoring the health status of its citizens and providing sound and reliable information about determinants that influence health status. By monitoring the health status across Europe, the Community intends to strengthen its ability to respond rapidly to emerging health threats. With this early warning function, the Community aims to increase quality of life expectancy and to reduce variations in health status and health outcomes across Europe.

By including EMS data in a Pan-European health monitoring system, information about the most serious diseases - cardiovascular disorders, respiratory diseases and injuries (cf. the "first hour quintet") – will be integrated into the Community's health surveillance strategy.

As a principal result, the EED project draws up a list of key indicators that are broadly available throughout Europe. The main focus is on access to the system, and operational and clinical issues, with economic efficiency also being considered. For the first time, health status, trends and determinants in the pre-hospital setting are examined based on these indicators. Specifically, it is possible to monitor and analyse the emergency demand or health care utilisation of a population including stratification for socio-demographic factors (cf. Figure 3).

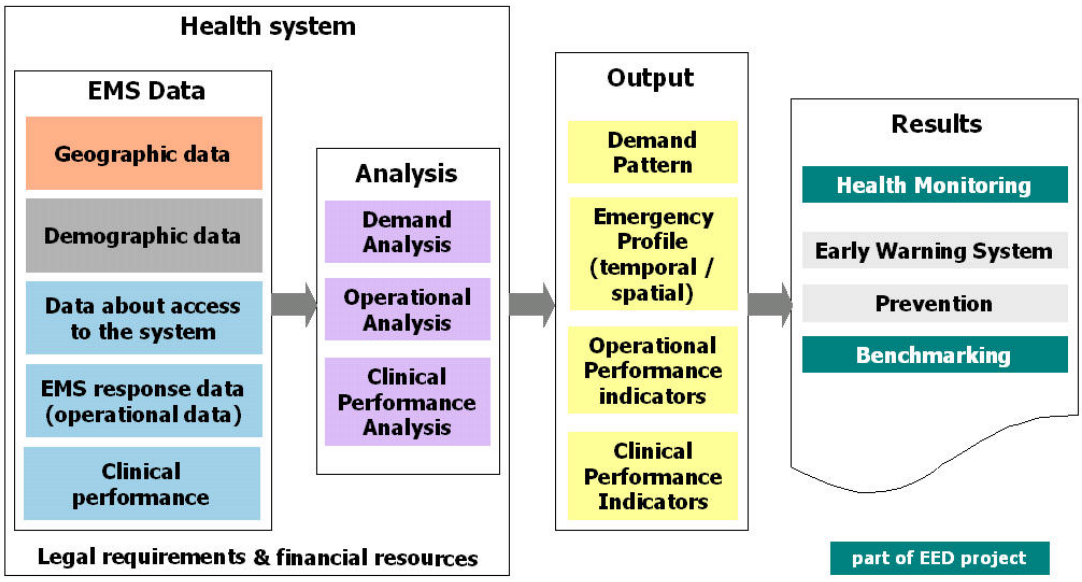


Figure 3: Public health surveillance based on EMS data

4.1 Pre-conditions - Common key components

4.1.1 Procedures

The variation and diversity of system designs is the main obstacle to comparing EMS systems. Comparative studies usually focus on one specific aspect of the system, such as staffing, costs or clinical outcomes. In contrast, a comprehensive comparison of the entire EMS system must include the tracking of the system's response to the patient' needs.[33]

Based on this assumption, the aim of the first EED workshop in November 2002 was to provide a detailed insight into the design and organisation of each participating EMS system. Independent of the respective system design and/or respective national health care system, the project has identified key common components and procedures that are present in EMS systems within the EU.

As a result, a generalised format for describing the patient journey from the first contact with the EMS system (access) until the recording of the outcome at the point of exiting the system has been developed and utilised for defining common indicators (cf. Figure 4).

[33] Overton, Stout 2002

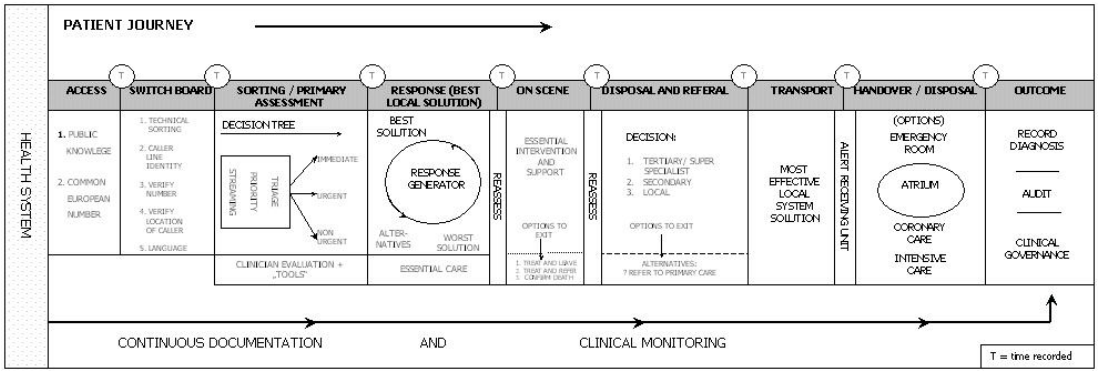
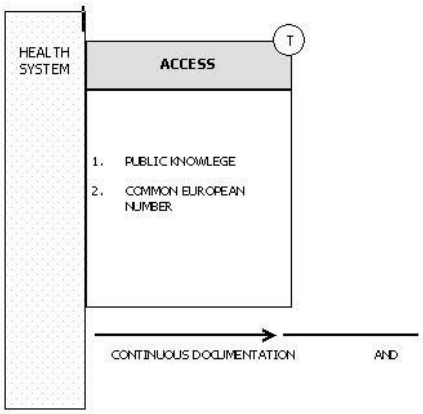


Figure 4: The "Patient Journey" template

The following are the key steps of the "Patient Journey":

- Access
- Switch Board
- Sorting/Primary Assessment
- Response (Best Local Solution)
- On Scene/Evaluation & Treatment
- Disposal and Referral
- Transport & Ongoing Care
- Handover/Disposal & Documentation
- Outcome

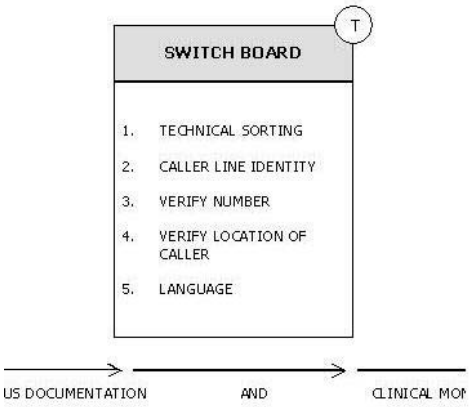
The project partners each provided a "Patient Journey" following the displayed template for a typical cardiac arrest and a typical chest-pain patient in their respective systems. Figure 5 demonstrates chest pain management including documentation procedures for each stage within the example EMS systems of Birmingham and Genoa. In italics, at each stage, a narrative suggesting best and worst practice is shown. In Appendix 3: "Patient Journey" by system we provide information for pathway information and skills described by each participating system for chest pain and cardiac arrest.



At 21:00, Mr. J.S suffers from sudden onset severe chest pain. The pain becomes increasingly worse radiating to his neck and left arm. He becomes pale and sweaty. His anxious wife decides he needs emergency care, as the pain is getting unbearable. At 21:15 his wife dials the emergency number.

Access

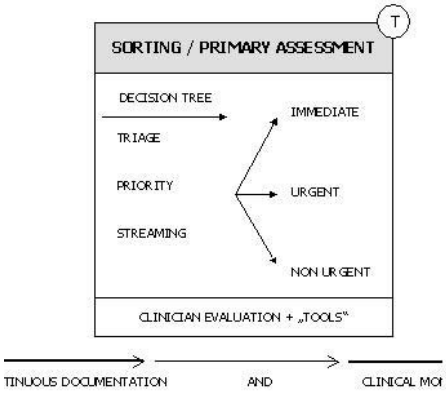
Birmingham	*Genoa*
Public Knowledge: • „999" UK-wide active Common European Number: • „112" UK-wide active but little used Documentation: • System records time, voice record of all callers. CLI (verified with caller) (cell phones excepted) • When 999 call received at British Telecom operations centre (specialist)	Public Knowledge: • „118" Italy-wide active (about 34% of patients with chest pain reach the ER by 118) Common European Number: • „112" is not active yet Documentation:



At 21:16 the call is received by the emergency operations centre. The operator asks for the location of the patient and the number they are dialling from. The operator verifies the location.

Switch Board

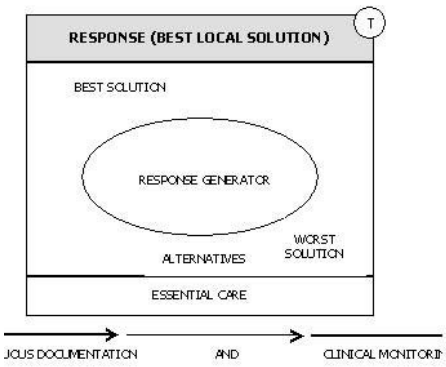
Birmingham	*Genoa*
Technical sorting: • 999/112 calls to British Telecom centre Caller line identity: • CLI on all calls Verify number: • Number check via operator CLI Verify location of caller: • Location verified Language: • English Documentation:	Technical sorting: • Not in use Caller line identity: • Not provided Verify number: • Provided on request by the public telephone company Verify location of caller: • Verified verbally by the operator Language: • Italian Documentation: • Opening of a computer generated form, now filled up with general patient information and the reported pathology



The caller is asked specific questions about the patient's problem.

Sorting / Primary Assessment

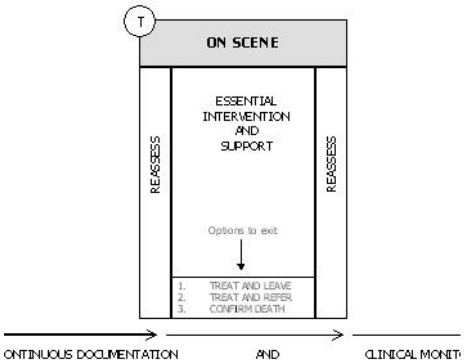
Birmingham	*Genoa*
Decision Tree: • AMPDS v. 10 or 11 Documentation: • CAD/AQUA (Monitored on tape and computer systems) • Calls recorded & continuous time from monitoring • Time when call enters & exits system	Decision Tree: IMMEDIATE (Red Code) • Patient age >= 35 years • Pain duration >=5 min. • Physical stress • Emotional stress • If pain irradiation is straight on jaw, left arm or back • Patient with cardiovascular diseases, diabetes, high blood pressure, respiratory diseases, embolism, PNX • Cardiovascular oriented medications • If pathology is accompanied by: vomit, sweating, URGENT (Yellow Code) • In all the other situations not included in the above Documentation: • Computer generated form is filled up with information obtained from evaluation of symptoms and consequential sorting



Having identified the patient's presenting complaint and established a priority, ambulance response is generated. Advice may be given to the patient on what to do while waiting for the ambulance. Ambulance mobile in high performance system in less than two minutes from call; in poorly performing systems delays occur.

Response (best local solution)

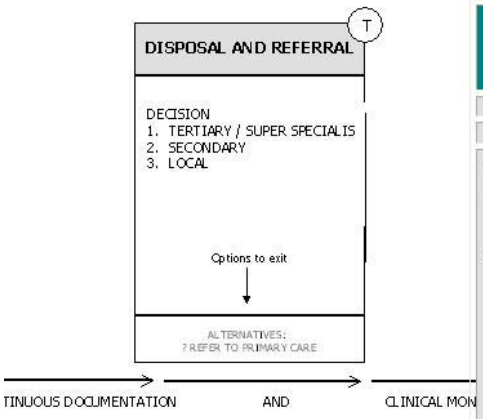
Birmingham	*Genoa*
Best solution: • BLS + ALS (dispatcher interrogates caller, Automatic Vehicle Locator (AVL) locates nearest resource and information sent to responder) Response generator: • closest appropriate unit Worst solution: • None Essential care: • Advice on resuscitation/First Aid and CPR from dispatcher until resource arrives Documentation: • all time frames recorded electronically	Best solution: • ALS mobile unit and BLS ambulance or EMS helicopter Response generator: • If patient refuses the ambulance EMS 118 regulating doctor can decide to dispatch non-emergency continuous assistance doctor at home, if available Worst solution: • BLS ambulance Essential care: • Operator suggests the patient be seated (possibly near the phone) , open neck collar, be quiet and calm. Documentation: • Telephone connection with closest ambulance station (Red Cross or Voluntary association, activation time is recorded on the EMS computer system



21:24: in high performance systems, ALS providers are on scene in less than eight minutes; prolonged delays may occur in other systems. If only an ELS response is provided, no defibrillator or advanced treatment is available to the patient. The patient is assessed by the ambulance crew and essential treatment is given. IF the crew has ALS skills, the patient may be given an intravenous line and treatments including analgesia and, where clinically indicated, thrombolysis. If the crew does not have ALS skills, only basic treatments may be given prior to transfer. Treatment on scene, including thrombolysis, may be completed within 12-15 minutes of arrival on scene. If advanced treatment is not given, the patient should leave within 10 minutes for rapid transfer to hospital.

On Scene

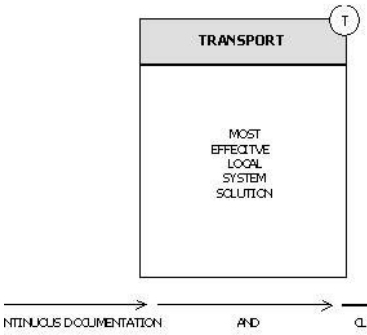
Birmingham	*Genoa*
Essential intervention and support: • History • Signs/Symptoms • Clinical Assessment • 12-lead ECG • Observation • Diagnosis • O_2, Aspirin • GTN • Pain relief with intravenous opiates • Thrombolysis given on scene	Essential intervention and support If ALS unit on scene: • ACLS protocol If BLS Unit on scene: • Vital Signs • "AMPLE" • Oxygen Therapy • Referral to EMS Centre • If rescuer reports a worsening and/or different situation, EMS centre can decide to dispatch ALS unit
Documentation: • E-PRF • Time of arrival on scene; arrival at patient's side; events & departure	Documentation: • Completion of on-site medical report with vital signs on arrival, treatment, results, action time recording by EMS centre and medical report



At 21:44 the patient is loaded into the ambulance, having been stabilised and given treatment, including opiate pain control and thrombolysis if appropriate. The ambulance control centre alerts the appropriate hospital receiving department at 21:45, after selecting the most appropriate hospital for definitive care.

Disposal and Referral

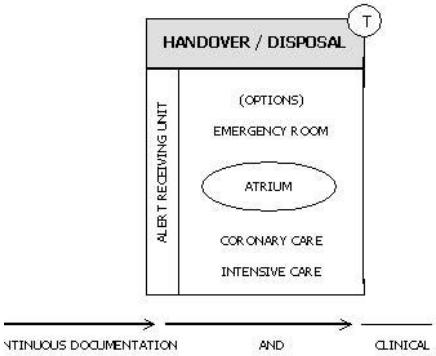
Birmingham	*Genoa*
Decision: • Minimum time to definitive treatment • Direct access to Coronary Care Unit if available	Decision: ALS unit on site: • ALS team performs ECG, transmitting it via GSM to Coronary Care for referrals. ALS team assigns a departure priority code and decides with EMS centre the best hospitalisation solution (ER Basic, ER with Intensive care unit, Coronary unit, etc.) BLS unit on site: • Reports vital signs and patient pathology evolution and lets EMS centre choose best hospitalisation solution and consequential departure priority code.
Documentation: • Time left scene • ECG monitoring + paper documentation	Documentation: • Completion of on-site medical report with vital signs after primary care, action time recording by EMS centre and medical report. BLS unit completes only a report containing basic therapy and priority code on site



During transit any complications are managed according to crew's specific skill levels, either ALS or BLS.

Transport

Birmingham	*Genoa*
Most effective local system solution: • AVL • Air / Ground • Pre-alert hospital • Telemetric ECG Documentation: • Transport time recorded	Most effective local system solution: If Red Code • BLS ambulance with ALS team on board, with medical care devices If Yellow Code • BLS ambulance Documentation: • Update medical/ambulance records with vital signs verified during transportation



The patient is delivered to hospital at 21:55. In some systems, the patient may be fast-tracked and admitted directly to a Coronary Care Unit (CCU). In other systems, the patient may be taken to the emergency room for further assessment, treatment and investigation. This may take up to 30 minutes, delaying definitive treatment. Patient documentation, possibly including an ECG and electronic recorded information, may be passed to the definitive care staff at handover.

Handover / Disposal

Birmingham	*Genoa*
Handover/Disposal options: Documentation: • Arrival at specialist unit • 'Handover' time • Time unit is clear • EOC record on CAD system • All are documented by crew	Handover/Disposal options: Emergency room • Urgent (Yellow priority code) Coronary care • Patient with acute coronary pathology (Red Code) Intensive care • Only for area covered by the First Regional Hospital (Red Code) Documentation: • ALS team accompanying the patient: Copy of medical record is handed over to the hospital medical staff trough the Triage Point • BLS ambulance only: rescuers inform the triage point about vital signs and pathology

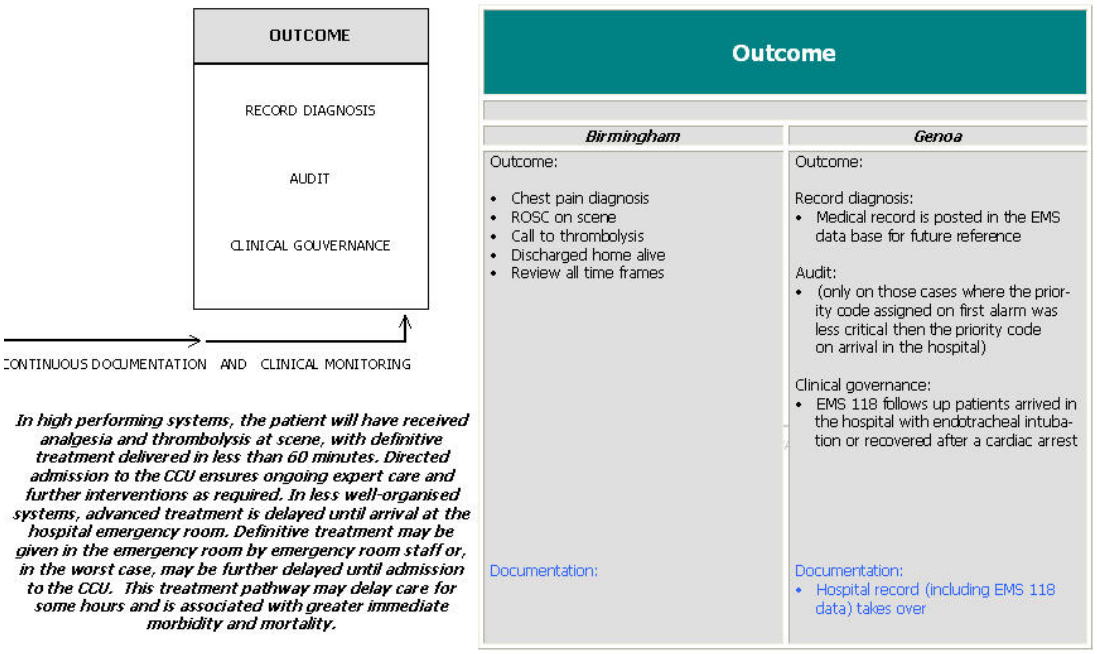


Figure 5: "Patient Journey" for two different EMS systems (Birmingham and Genoa)

4.1.2 Data availability and collection

Each system participating in the project was described in detail using the same methodology outlined in chapter 4.1.1. Components were identified and recorded, including logistics, clinical and assessment information, treatment availability, and the skill mix in each system (cf. Appendix 4: Data availability by system from run sheet information and Appendix 5: Short description of sample EMS systems). The mechanisms of data capture and recording were also identified, and an analysis was presented on a system-by-system basis. **It must be noted, that the information presented in this report relates to systems and not to overall national standards. It must also be noted, that for quite a few participating countries there were no national standards due to a legal responsibility of regional/state or local authorities for setting and controlling EMS regulations.**

Figure 6 shows the tabulation of the list of common core information collected as a standard routine by 10 or more out of 13 systems.

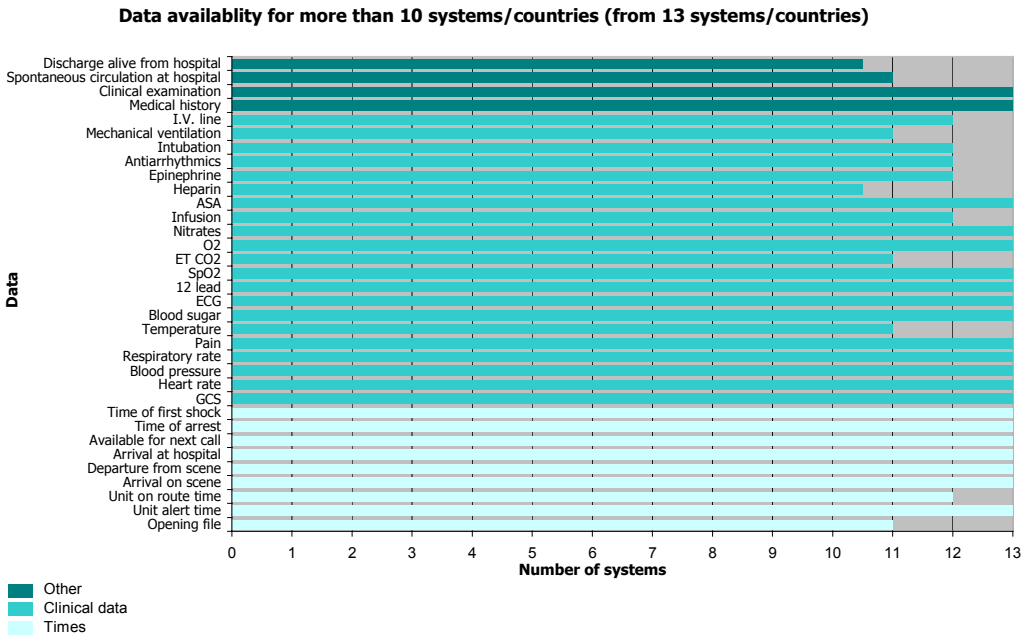


Figure 6: Data availability for more than 10 systems/countries (impact)

4.2 Indicators

4.2.1 Towards an EMS indicator system

The expert panel used an iterative process to identify common data points and definitions, building the basis for identifying relevant EMS indicators. Out of more than 100 original proposed indicators, the panel agreed to a list of 46 EMS indicators (master list) (cf. Appendix 6a: Indicators - List of indicators) that were to be tested in the first pilot data collection. The details of the definition, narrative and rationale for this first list of indicators are provided in Appendix 6b: Indicators - accompanying documents.

The 46 indicators of the master list were critically reviewed by the expert group and the steering committee in consecutive steps. Using the selection criteria indicated in chapter 3 the list was confined to the following five key indicators recommended for integration into the ECHI short list.

4.2.2 Key Indicators

The expert panel and the steering committee reached the consensus to recommend the following five key indicators for inclusion into the ECHI database:

A) Unit hours (ELS + BLS + ALS) p. a. / 100,000 inhabitants

Indicator of organised EMS resources

Rationale:

This indicator measures the availability of professional emergency, basic and ad-

vanced life support (ELS, BLS, ALS) available to the population. For calculation purposes, the numbers of professionally staffed unit hours of ELS, BLS or ALS are added over a 365-day period.

Emergency Life Support (ELS) is an important part of the chain of survival, bringing CPR and basic ventilation to the patient and supporting life function until the arrival of BLS and/or ALS units. The continuous availability of organised Basic Life Support (BLS) and/or Advanced Life Support (ALS) is the critical yardstick for evaluating pre-hospital emergency care. In the different European EMS systems ALS may be performed by paramedics, nurses and/or emergency physicians.

B) Response time (% within 480 sec) for highest priority p. a.

Indicator of EMS performance and access to an organised EMS system

Rationale:

This indicator measures the time to pre-hospital emergency care for patients who are presumed to be in a life-threatening condition and for whom pre-hospital care has been summoned by alerting the appropriate EMS system (dispatch centre). Using the presented format it indicates the ability of the system to meet the widely accepted 8-minute response-time standard. The data has to be provided by percentiles. Average response times are not only misleading, they are also clinically inappropriate.

C) Rate of highest priority responses p. a. / 100,000 inhabitants

Indicator for utilisation and demand/workload of organised EMS systems

Rationale:

This indicator defines patient access to EMS systems in three ways:

- Captures the total number of requests for highest priority responses, a potential determinant of the overall health of the inhabitants in the EMS systems catchment area,
- Used to analyse calls that are prioritised as life-threatening compared with those prioritised as non-life-threatening to determine proper protocol utilisation and
- Establishes a rate per 100,000 inhabitants, comparing both system access and dispatcher actions with other EMS systems

D) Rate of FHQ incidences p. a. / 100,000 inhabitants

A measure of EMS demand for critical conditions requiring immediate and prompt medical intervention (cardiac arrest, acute coronary syndrome, stroke, respiratory failure and severe trauma).

Rationale:

Calculated as rate of diagnoses per annum and per 100,000 inhabitants, the rate of First Hour Quintet incidences is an indicator for the health status of the tar-

get population and of EMS system workload.

E) Rate of ALS interventions p. a. / 100,000 inhabitants

Indicator for the level of care provided by the organised EMS system (e.g., drug administration, assisted ventilation, intubation)

Rationale:

Calculated by counting ALS interventions, including assisted ventilation, intubation and intravenous drug infusion, this indicator provides information on EMS system performance and workload. It is a simplified indicator for the level of pre-hospital emergency care provided to the population.

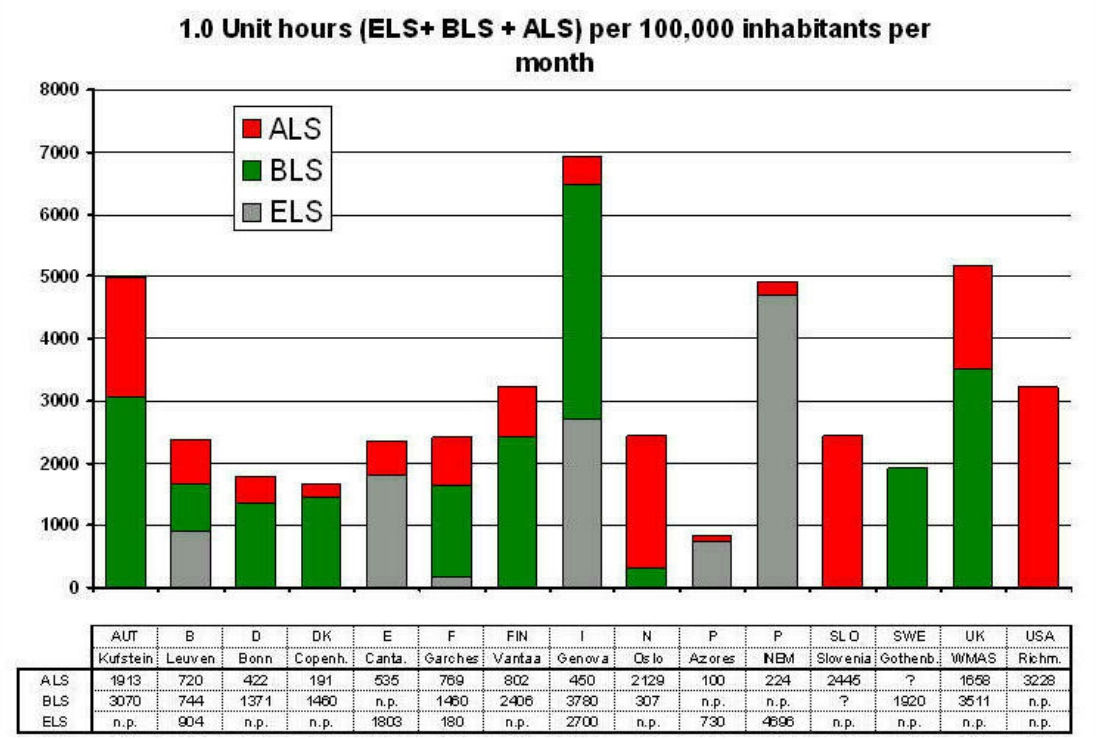
Indicators A, B, D and E are composite indicators containing other markers that may be used independently. These independent markers may be reliable indicators when used individually.

4.2.3 Experiences and recommendations

Figure 7-Figure 11 present data from the sampling period in June 2003. During this period, reliable data was gathered for all indicators from the majority of the project participants.

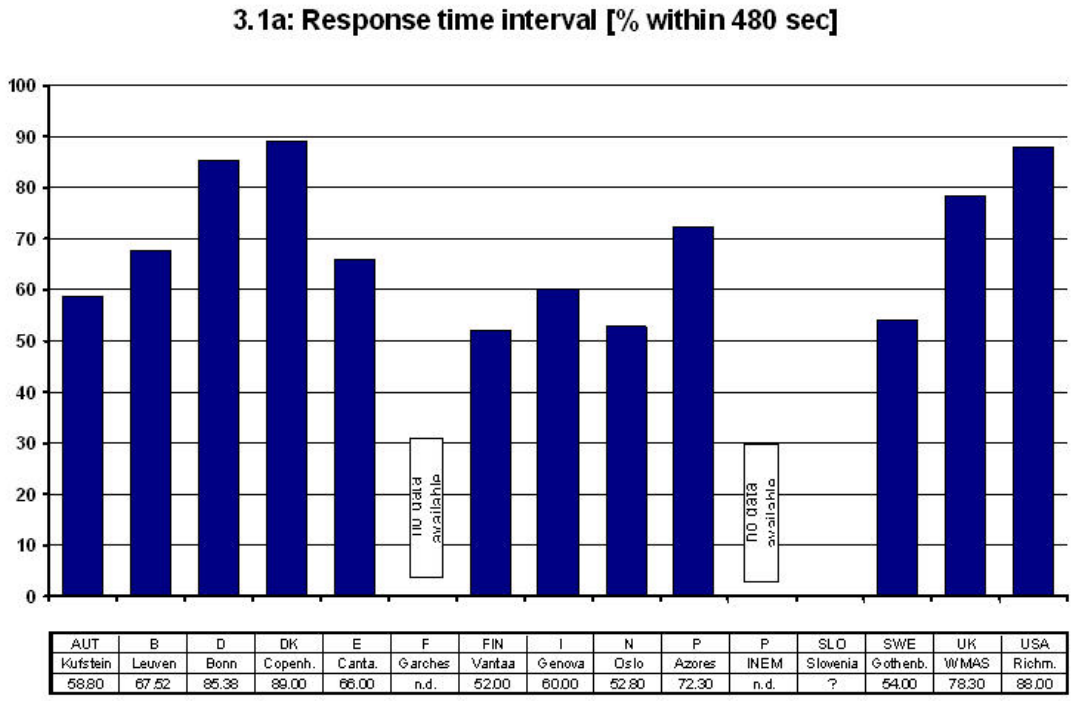
Although Portugal did not submit data during the data period due to restructuring of its national EMS system, it actively participated in reaching a consensus and making recommendations.

Some partners had difficulty manually collating available data for submission. All partners reported that the primary data required was available.



	AUT	B	D	DK	E	F	FIN	I	N	P	P	SLO	SWE	UK	USA
	Kufstein	Leuven	Bonn	Copenh.	Canta.	Garches	Vantaa	Genova	Oslo	Azores	INEM	Slovenia	Gothenb.	WMAS	Richm.
ALS	1913	720	422	191	535	769	802	450	2129	100	224	2445	?	1658	3228
BLS	3070	744	1371	1460	n.p.	1460	2406	3780	307	n.p.	n.p.	?	1920	3511	n.p.
ELS	n.p.	904	n.p.	n.p.	1803	180	n.p.	2700	n.p.	730	4696	n.p.	n.p.	n.p.	n.p.

Figure 7: Unit hours (ELS+BLS+ALS) per 100,000 inhabitants per month



AUT	B	D	DK	E	F	FIN	I	N	P	P	SLO	SWE	UK	USA
Kufstein	Leuven	Bonn	Copenh.	Canta.	Garches	Vantaa	Genova	Oslo	Azores	INEM	Slovenia	Gothenb.	WMAS	Richm.
58.80	67.52	85.38	89.00	66.00	n.d.	52.00	60.00	52.80	72.30	n.d.	?	54.00	78.30	88.00

Figure 8: Response time interval [% within 480 sec]

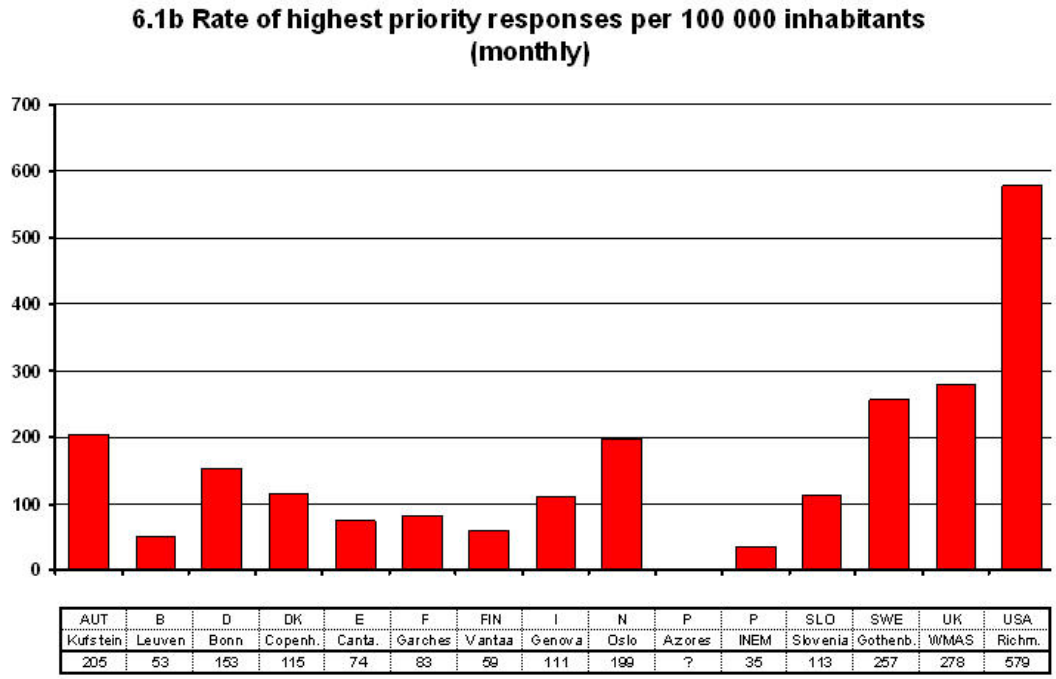
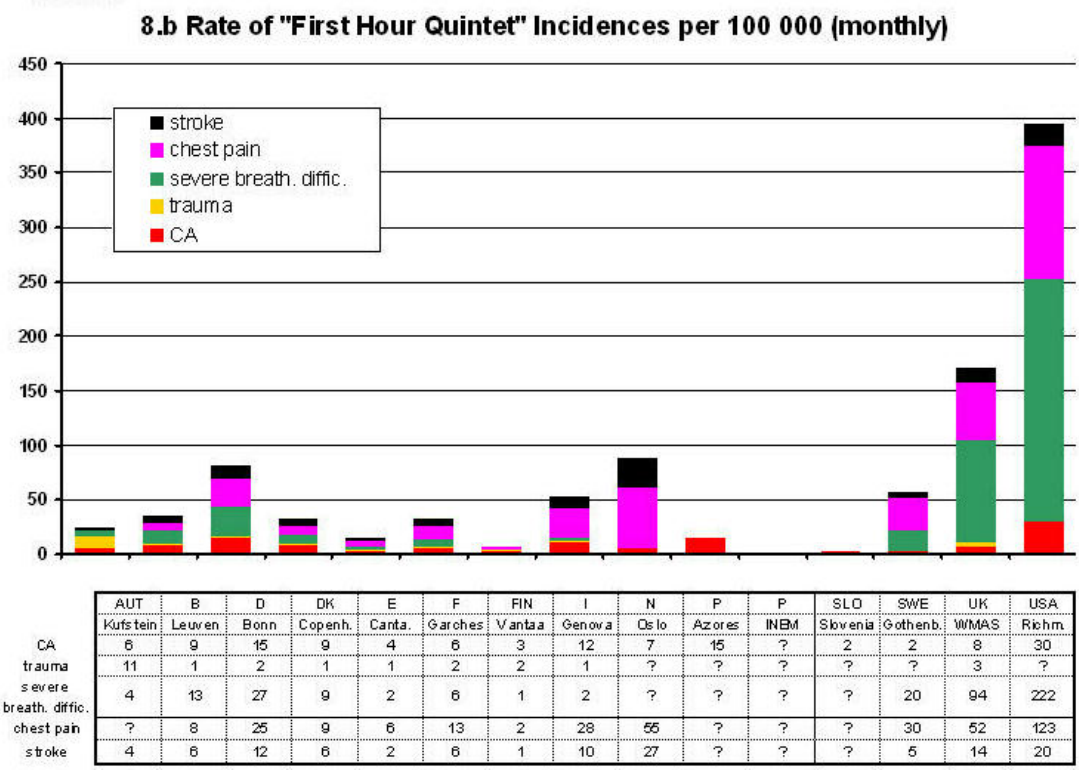
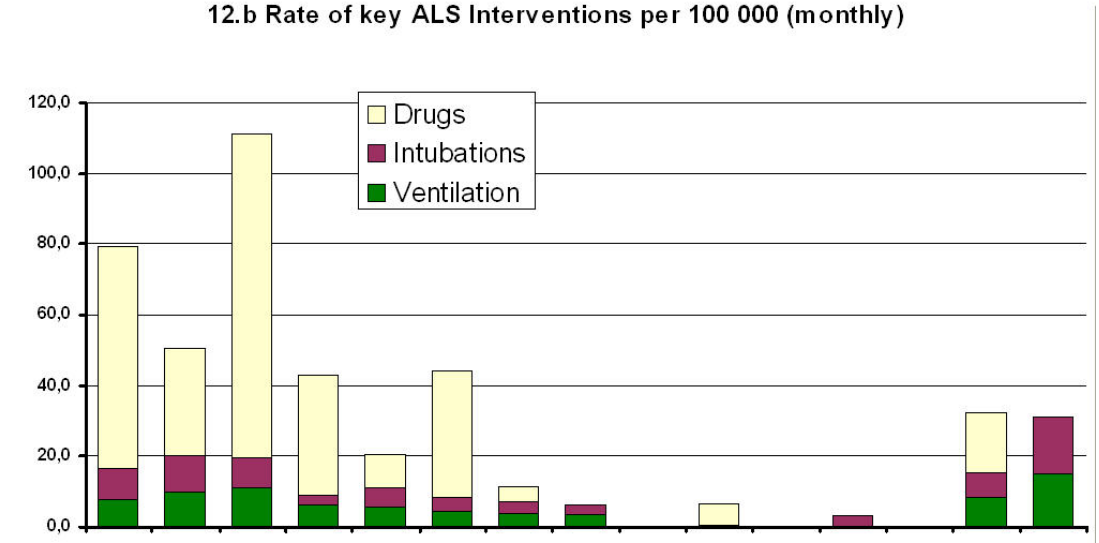


Figure 9: Rate of highest priority responses per 100,000 inhabitants per month



	AUT Kufstein	B Leuven	D Bonn	DK Copenh.	E Canta.	F Garches	FIN Vantaa	I Genova	N Oslo	P Azores	P INEM	SLO Slovenia	SWE Gothenb.	UK WMAS	USA Richm.
CA	6	9	15	9	4	6	3	12	7	15	?	2	2	8	30
trauma	11	1	2	1	1	2	2	1	?	?	?	?	?	3	?
severe breath. diffic.	4	13	27	9	2	6	1	2	?	?	?	?	20	94	222
chest pain	?	8	25	9	6	13	2	28	55	?	?	?	30	52	123
stroke	4	6	12	6	2	6	1	10	27	?	?	?	5	14	20

Figure 10: Rate of "First Hour Quintet" Incidences per 100,000 inhabitants per month



	AUT	B	D	DK	E	F	FIN	I	N	P	P	SLO	SWE	UK	USA
	Kufstein	Leuven	Bonn	Copenh.	Canta.	Garches	Vantaa	Genova	Oslo	Azores	INEM	Slovenia	Gothenb.	WMAS	Richm.
Ventilation	8,0	10,0	11,0	6,3	5,6	4,3	3,8	3,4	?	0,0	?	0,0	?	8,1	15,0
Intubations	8,4	10,0	8,7	2,7	5,6	3,9	3,3	2,9	?	0,4	?	3,3	?	7,4	16,0
Drugs	63,1	30,5	91,7	33,8	9,5	36,0	4,4	0,0	?	6,3	?	0,0	?	17,0	?
	doc	doc	doc	doc	doc	doc	para/doc	doc	doc	tech	?	doc	nurse/para	para/tech	para

Figure 11: Rate of ALS interventions p. a. / 100,000 inhabitants per month

4.2.4 Further recommendations

"Time to first shock" is a good example of the problems of providing sound and reliable information on crucial emergency medical processes. "Time to first shock" marks the interval between collapse after cardiac arrest and application of the first defibrillatory shock in patients suffering from ventricular fibrillation. Defibrillation is a Type-1 evidence-based clinical intervention. The time period determines the chances of good neurological recovery and/or survival after cardiac arrest and is therefore considered to be one of the most crucial indicators for EMS performance. The pilot study revealed significant limitations regarding availability and comparability of this key indicator. While some systems have been able to successfully provide "time to first shock" as part of clinical research, it was agreed by the expert panel that this data could not be provided as a standard routine for most of the participating systems and therefore could not be used.

There is consensus that this indicator is essential for the future. However, due to the current limitations, "time to first shock" was not included in the list of recommended EMS key indicators.

4.3 Integration into the European Commission's public health strategy 2003-2008

The European Commission (EC) can contribute to the goal of a "Europe of Health" by facilitating access to information that reveals its diversity. To achieve this goal, the EC will be seeking to produce comparable information on the health and health-related behaviour of the population, on health promotion, and on diseases and health systems under the Information and Knowledge Strand of the new public health programme. At the heart of this new information facility will be agreed-on, European-wide indicators developed under the Health Monitoring Programme 1997-2002 and harmonised with respect to their definition, their collection and their use.[34] There has been increasing interest within the EU and also within other international institutions such as the World Health Organisation (WHO) and the Organisation for Economic Co-operation and Development (OECD) in "Health System Performance Assessment" (HSPA), and in the international benchmarking of health systems.[35]

The results of the EED project contribute to both these topics. The project has developed and tested indicators that provide information on EMS as an important part of the health system and also provide a methodology on benchmarking EMS systems. The EED project is collaborating with the Working Party on Health Systems, established in 2003 as part of the new public health programme, which aims to decide, define and render operational a series of information items required to monitor Europe-wide, national and sub-national developments in the field of health systems.

The EED project links into the European Community Health Indicators (ECHI) project, which is also financed by the European Health Monitoring Programme. The ECHI project developed a proposal for a set of European Community Health Indicators. Experts from all EU Member States, Norway, Hungary, WHO Europe and OECD participated. The ECHI project group suggested the following main categories of indicators:

- Demographic and socio-economic factors
- Health status
- Determinants of health
- Health services and health promotion (called "health systems")

In the first phase of the project, the aim was to develop a broad list of indicators. This list was required to be comprehensive and coherent, covering all domains of public health. The project was to take into account earlier work, especially by WHO Europe, OECD and EUROSTAT. Beyond that, the list was to cover the priority areas that Member States and Community health policies currently pursue. One way

[34] Byrne 2003

[35] cf. Kramers 2003; OECD 2000 and WHO 2000

to achieve comprehensiveness was to incorporate results from other projects financed under the Health Monitoring Programme that cover specific areas of public health. In most cases, the proposed ECHI indicators were defined as generic indicators. Their actual operational definitions were - and still are in progress of being – developed by the respective projects.

In the second phase of the project, this comprehensive list of indicators was reduced to a "short list of core indicators".

The EED project proposed the following five key indicators for incorporation in the ECHI "short list of core indicators" for monitoring health in the field of pre-hospital emergency care (including ECHI-Indicator-Class), which meet the ECHI-recommendations for validity, timeliness, sensitivity and comparability:

1. Unit hours ELS + BLS + ALS per 100,000 inhabitants (with 3 sub-indicators for ELS, BLS and ALS) → Health System/ Resources

2. Response time (with 2 sub-indicators: 90% percentile and percentage ≤ 480 sec) → Health System/ Performance

3. Rate of highest priority responses per 100,000 inhabitants → Health System/ Utilisation

4. Rate of FHQ diagnoses per 100,000 inhabitants (with 5 sub-indicators: cardiac arrest incidents, severe trauma incidents, severe breathing difficulties, cardiac chest pain incidents and stroke incidents) → Health Status / Mortality; Morbidity

5. Rate of ALS interventions per 100,000 inhabitants (with 3 sub-indicators: assisted ventilation, intubation and iv drug administration) → Health System/ Performance

The current ECHI-II-Core list of indicators was presented at the second meeting of the Health Systems Working Party, and it was recommended that there be only a few indicators measuring service processes and the quality of those services. The EED project key indicators provide these process measurements for the pre-hospital setting, while also meeting another recommendation to the ECHI-II list: they can be continuously created out of already existing, routinely collected data.[36]

[36] Health Systems Working Party 2004

5 Benchmarking EMS systems

The third objective of the EED Project was "to develop crucial indicators from evidence-based data and to allow further comparisons among different member states." The methodology chosen to conduct the comparison was termed benchmarking.

Communities across the Member States, and Europe, provide EMS to their citizens using a variety of different system designs. Presently, more than forty different designs for providing this essential service have been identified internationally. The design of the EMS system can range from physician services based in hospitals in France, to municipal departments in the United Kingdom, to closed market competition in Denmark.[37]

The wide variation in system design has been problematic for those attempting to compare a system using any traditional methodology. Usually, a comparison focuses on one specific aspect of the system, such as staffing and resource patterns.[38] Other attempts have identified specific system designs and attempted to survey one component such as costs.[39] Finally, the need to measure clinical outcomes has lead researchers to examine variables both within and between systems in an attempt to optimise the researchers' knowledge of both EMS system designs' attributes and patient outcome.[40]

The creation of a conceptual framework for comparing EMS systems of diverse design must track as many common attributes as possible. The conceptual framework must form a stable platform to compare the total system performance, clinical and fiscal, to provide the foundation for health surveillance monitoring.

Historically, EMS systems were developed by local governments as its role in the healthcare delivery system was not recognized until only recently. The resulting diversity has created difficulties when attempting to compare systems and develop common indicators for benchmarking.[41] However, recent benchmarking projects have, both in North America and among the Member States, demonstrated the benefits of the process for measuring clinical outcome and fiscal performance.[42,43]

Benchmarking is the art and science of comparing a system or system component with the best-measured performance or performance criteria. Accurate benchmarking requires standardized definitions, reliable data, accurate reporting and

[37] Overton, Stout 2002

[38] Braun, McCallion, Fazackerley 1990

[39] Heyman 1985.

[40] Eisenberg et al. 1990

[41] Bossaert 1993

[42] Krafft et al. 2003

[43] Overton 2003

common measurement methodology. In addition, it is necessary to include information regarding system demographics and performance to establish comparability among the systems.

The survey instrument used was first introduced in North America in 1997 and evolved to be used in the years 2000 and 2002 for more sophisticated projects. It was determined by the EU Member States that substantial changes would be needed in the survey instrument to both ensure its comparability for the data needed by the European communities and capture additional information regarding the unique operational aspects of the EMS systems. Specific additional questions were required to establish comparability and to measure and calculate economic performance. Using the previous testing methodology, a draft survey was completed by EMS systems in Bonn, Germany, Cantabria, Spain, and Birmingham, United Kingdom. The results were reviewed and the survey revised prior to dissemination.

Surveys were completed by participating Member States and returned to the principal investigator in late 2003. The results were then calculated and are reported in four areas: General Information, Response Time Reliability, Clinical Capabilities, and Economic Efficiency. Each area is accompanied by a brief overview.

The following systems were participants in this study:

- Leuven, Belgium
- Copenhagen, Denmark
- SAMU 92, France
- Genoa, Italy
- Kufstein, Austria
- Bonn, Germany
- Richmond, VA, USA
- Vantaa, Finland
- Cantabria, Spain
- Ulleval, Norway
- West Midlands, UK

5.1 General Information

The initial step in establishing comparability was to examine system characteristics and demographics. Information was gathered that encompassed the geographical size and population of the service area, the number of responses, and the number of patient transports. This information was provided in both table and graph format for convenience. Further analysis provided the emergency transports per square kilometre and per 10,000 populations as both impact on system utilization, and ultimately, economic efficiency.

Physical Characteristics		
System	**Service Area (square kilometres)**	***Population***
Leuven, Belgium	300	450,000
Copenhagen, Denmark	90	600,000
SAMU 92, France	176	1.500,000
Genoa, Italy	1,831	778,000
Kufstein, Austria	970	95,104
Bonn, Germany	141	341,303
Richmond, VA, USA	163	197,790
Vantaa, Finland	242	180,000
Cantabria, Spain	5,321	537,506
Ulleval, Norway	4,916	480,000
West Midlands, UK	4,383	3,091,488
Mean	1,685	750,108
Median	300	480,000

Table 1: Physical Characteristics

Emergency Transports			
System	***Total***	**Per Square Kilometre**	**Per 10,000 Population**
Leuven, Belgium	5,573	19	124
Copenhagen, Denmark	10,205	113	170
SAMU 92, France	57,000	324	380
Genoa, Italy	23,609	13	303
Kufstein, Austria	7,310	8	769
Bonn, Germany	16,299	116	478
Richmond, VA, USA	28,899	177	1,461
Vantaa, Finland	4,952	20	275
Cantabria, Spain	3,034	1	56
Ulleval, Norway	23,083	5	481
West Midlands, UK	327,050	75	1,058
Mean	46,092	79	505
Median	16,299	20	380

Table 2: Emergency Transports

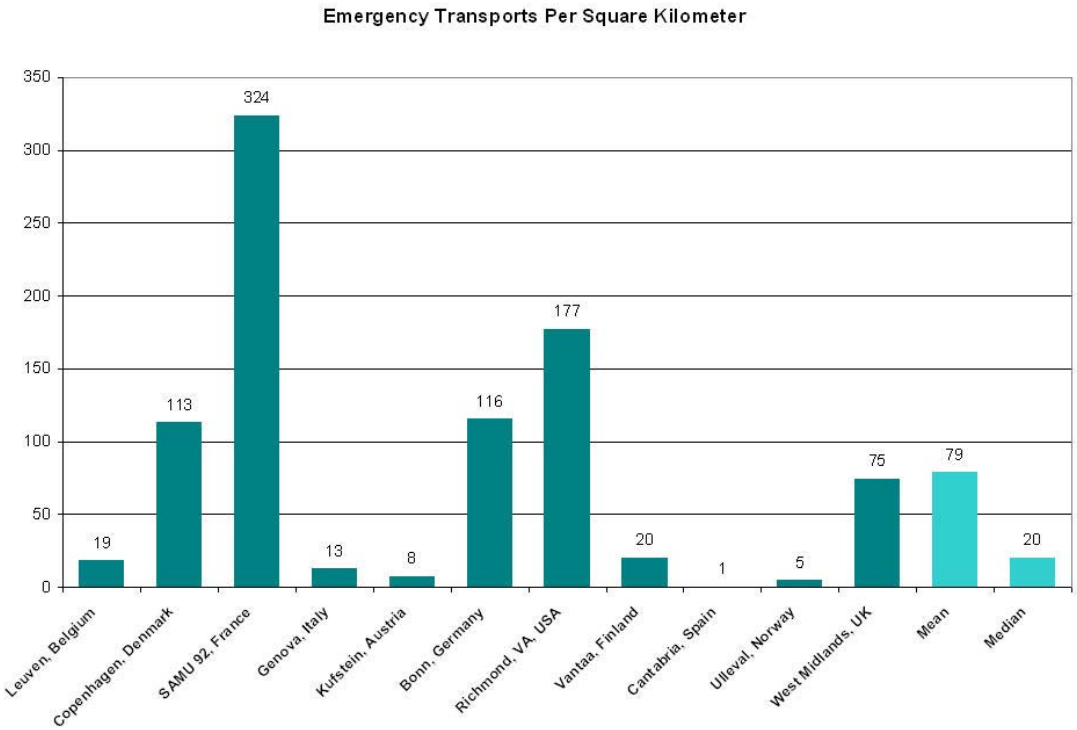


Figure 12: Emergency Transports Per Square Kilometre

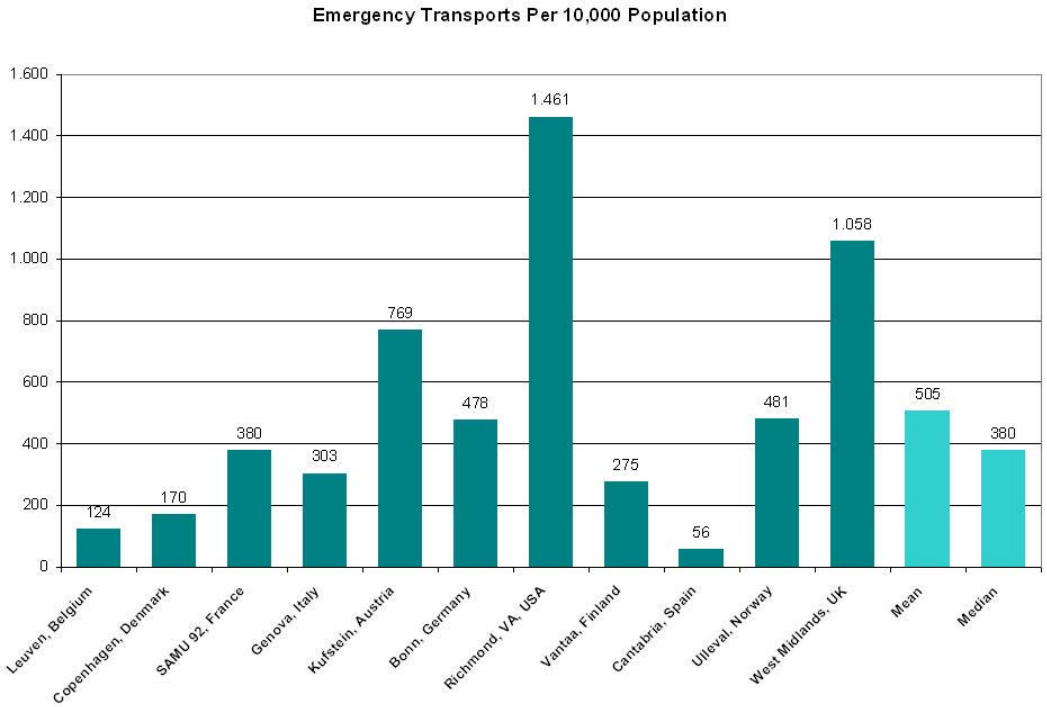


Figure 13: Emergency Transports Per 10,000 Populations

5.2 Response Time Reliability

A response time standard, or the cost of readiness, becomes the single most significant variable for determining the cost of providing service. This section provides an overview of the methodology used to determine response time measurement and quantifies certain vehicle variables that contribute to or detract from the ability to respond.

The most important factor in achieving successful cardiopulmonary resuscitation is the speed of response. The survival rate from untreated ventricular fibrillation decreases up to 10% for every minute that passes and the condition is untreated.[44] Responding with Basic Life Support with early defibrillation capability within four minutes and Advanced Life Support within eight minutes further improves the patient's chance of survival.[45, 46] The eight-minute response time has become the recognized standard to provide EMS in an urban setting.[47]

Traditionally, response times had been measured as an average. However, to ensure equitable service to all segments of a community, fractile response time measurement was introduced. A fractile response time measurement establishes a percentage of reliability that must be met for patients experiencing an emergency event.[48]

Participants in this project specifically requested inclusion of questions regarding ambulance fleet management. It was important to compare the vehicles' useful life and the various replacement policies to allow the establishment of a best practice among the systems and compare vehicle collisions and failures.

Benchmarking response times among the EU Member States presented a challenge. Not every Member State measures response times and those that did begin the measurement at different starting points. Several systems begin the measurement when the telephone is answered, others when certain pieces of information are received from the calling party and still others when the ambulance is dispatched. As a result, data could only be compared for six EMS systems.

[44] Advanced Life Support Working Party of the European Resuscitation Council 1992

[45] Eisenberg, Bergner, Hallstrom 1980a

[46] Eisenberg, Bergner, Hallstrom 1980b

[47] Commission on Accreditation of Ambulance Services. Glenview, IL, 201 Clinical Standard; 201.05 Response times.

[48] Overton, Stout 2002

Life Threatening Emergency Response Time Standards		
System	**Minutes / Seconds**	**Compliance standard**
Copenhagen, Denmark	04:45	no data
Genoa, Italy	08:00	no data
Bonn, Germany	07:59	90%
Richmond, VA, USA	08:59	90%
Ulleval, Norway	09:39	no data
West Midlands, UK	08:00	75%
Mean	07:53	07:53
Median	08:00	08:00

Table 3: Life Threatening Emergency

Reported Fleet Size	
EMS Systems	
System	**Fleet Size**
Leuven, Belgium	9
Copenhagen, Denmark	40
SAMU 92, France	71
Genoa, Italy	100
Kufstein, Austria	21
Bonn, Germany	27
Richmond, VA, USA	26
Vantaa, Finland	5
Cantabria, Spain	24
Ulleval, Norway	34
West Midlands, UK	190
Mean	50
Median	27

Table 4: Reported Fleet Size

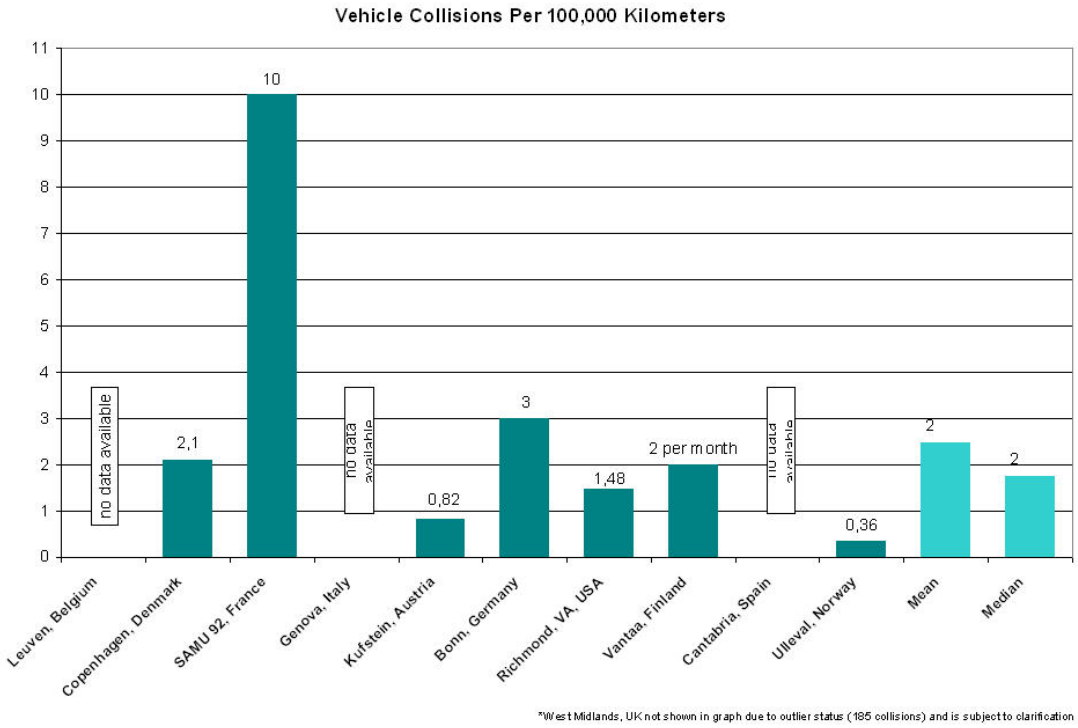


Figure 14: Vehicle Collisions per 100,000 km

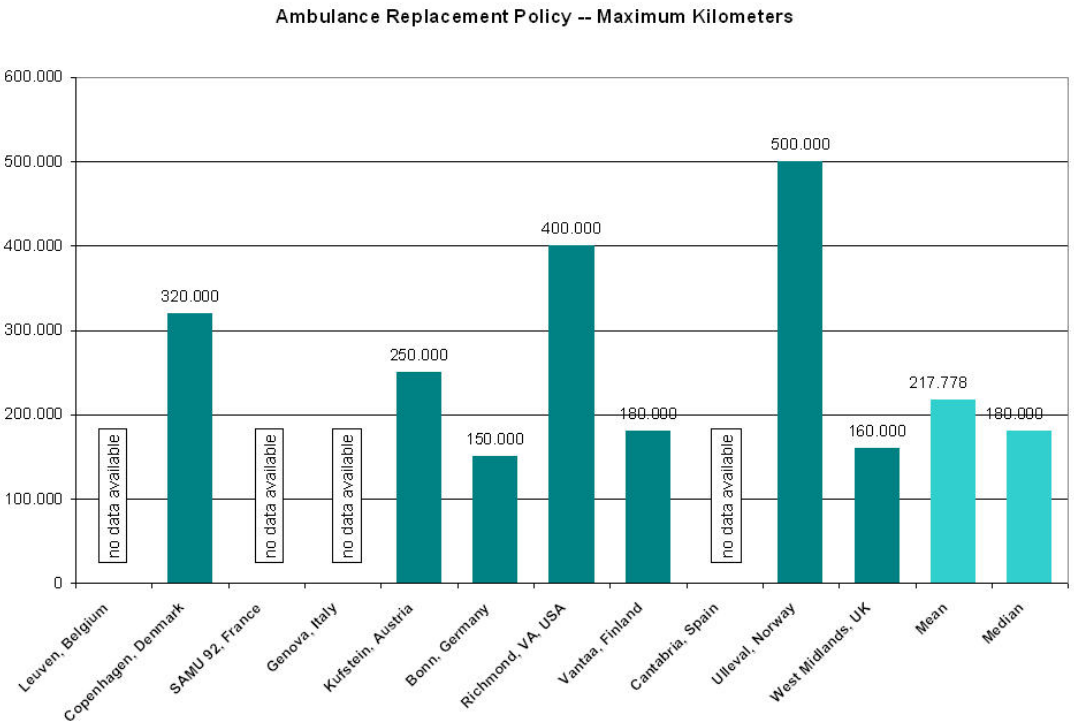


Figure 15: Ambulance Replacement Policy – Maximum Kilometres

5.3 Clinical Capability

All EU Member States provide EMS systems. However, the type of staffing differs. The vehicles in every system are equipped and stocked with supplies to treat the medical needs of any patient needing emergency care in the pre-hospital environment in that system.

As EMS has advanced and new treatment modalities have been introduced, additional training for advanced personnel has been required. This includes Advanced Cardiac Life Support (ACLS), Pre-Hospital Trauma Life Support (PHTLS), and Paediatric Advanced Life Support (PALS) or their equivalents. In many locales, training opportunities are limited, but a number of EMS systems either have obtained or are striving for 100 percent certification.

Patient care begins when the telephone rings. For those calls where information is available, Emergency Medical Dispatchers (EMD) trained to deliver Dispatch Life Support (DLS) through the use of pre-arrival instructions can, and do, make a difference. Some systems use protocol driven dispatch algorithms for determining the severity level of the patient, the type of responding resources that may be needed, and the assistance that can be given by the dispatcher prior to arrival of the ambulance.[49] The training level for the dispatcher varies among the different systems.

Most EMS systems collect and use data regularly to meet the requirements for performance monitoring. The systems have been challenged to conduct research and report results. This benchmarking study provides an approach at such reporting. Respondents were requested to report survival from cardiac arrest using the Utstein template and the results are graphically displayed.[50]

[49] Clawson 2002a

[50] Cummins et al. 1991

Minimal ALS Staffing	
EMS Model Systems	
System	**Number and Type of Staffing**
Leuven, Belgium	1 nurse, 1 physician
Copenhagen, Denmark	1 intermediate, 1 basic
SAMU 92, France	1 physician, 1 nurse, 1 EMT
Genoa, Italy	1 nurse, 1 physician
Kufstein, Austria	1 physician, 1 EMT
Bonn, Germany	1 paramedic, 1 physician
Richmond, VA, USA	1 paramedic, 1 basic
Vantaa, Finland	2 paramedics
Cantabria, Spain	1 physician, 1 nurse, 2 basic
Ulleval, Norway	1 paramedic, 1 intermediate
West Midlands, UK	1 paramedic, 1 basic

Table 5: Minimal ALS Staffing

Clinical Certifications			
System	**ACLS Certified**	**PHTLS (or equivalent) Certified**	**PALS (or equivalent) Certified**
Leuven, Belgium	no data	no data	no data
Copenhagen, Denmark	85%	65%	no data
SAMU 92, France	no data	no data	no data
Genoa, Italy	20%	60%	20%
Kufstein, Austria	100%	no data	no data
Bonn, Germany	100%	no data	no data
Richmond, VA, USA	97%	97%	96%
Vantaa, Finland	14%	not available	not available
Cantabria, Spain	100%	100%	100%
Ulleval, Norway	81%	98%	0%
West Midlands, UK	7%	20%	5%
Mean	67%	73%	44%
Median	85%	81%	20%

Table 6: Clinical Certifications

Emergency Medical Dispatchers
Minimum Certification Required for Ambulance Dispatcher

System	EMD	Basic	Inter-medi-ate	Para-medic	CPR	No Certi-fication Required	Fire Fighter	Other
Leuven, Belgium								yes
Copenhagen, Denmark						yes		
SAMU 92, France								yes
Genoa, Italy					yes			yes
Kufstein, Austria	yes	yes			yes			
Bonn, Germany	yes			yes			yes	Fire squad leader
Richmond, VA, USA	yes		yes		yes			
Vantaa, Finland								National Training
Cantabria, Spain						yes		Certification
Ulleval, Norway			yes					
West Midlands, UK	yes							Nurses

Table 7: Emergency Medical Dispatchers – Minimum Certification Required for Ambulance Dispatchers

Quality Improvement Case Review
with Chart Review

System	Chart Review	Percentage
Leuven, Belgium	no data	
Copenhagen, Denmark	yes	3%
SAMU 92, France	yes	
Genoa, Italy	no	
Kufstein, Austria	no	
Bonn, Germany	yes	100%
Richmond, VA, USA	yes	100%
Vantaa, Finland	no	100%
Cantabria, Spain	yes	100%
Ulleval, Norway	yes	
West Midlands, UK	yes	100%

Table 8: Quality Improvement Case Review with Chart Review

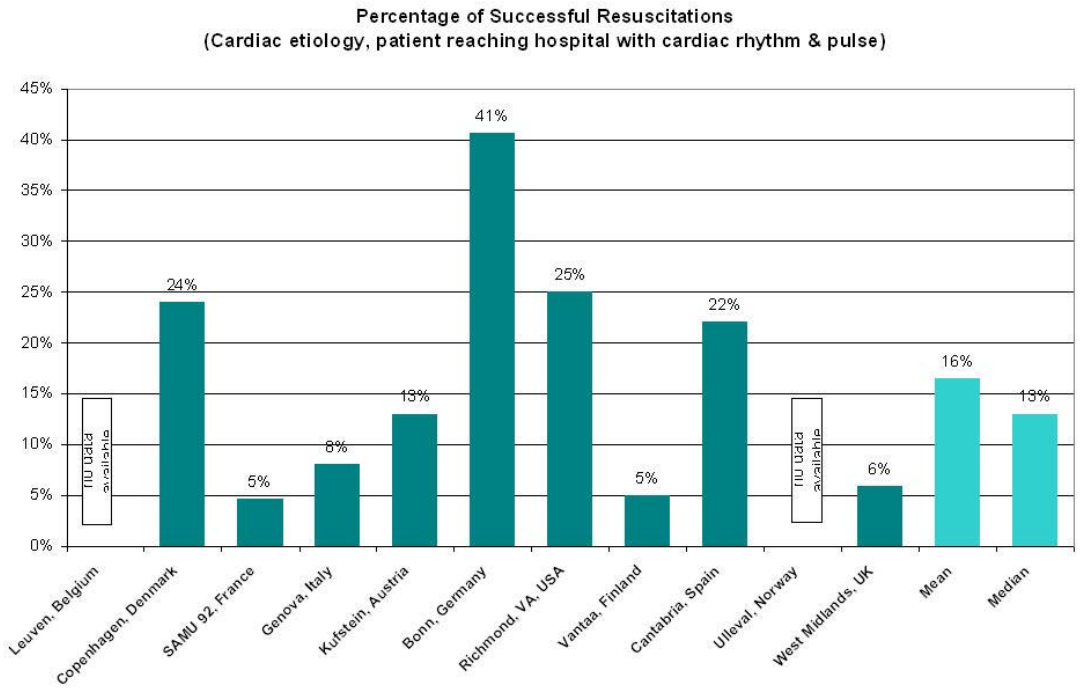


Figure 16: Percentage of successful Resuscitations

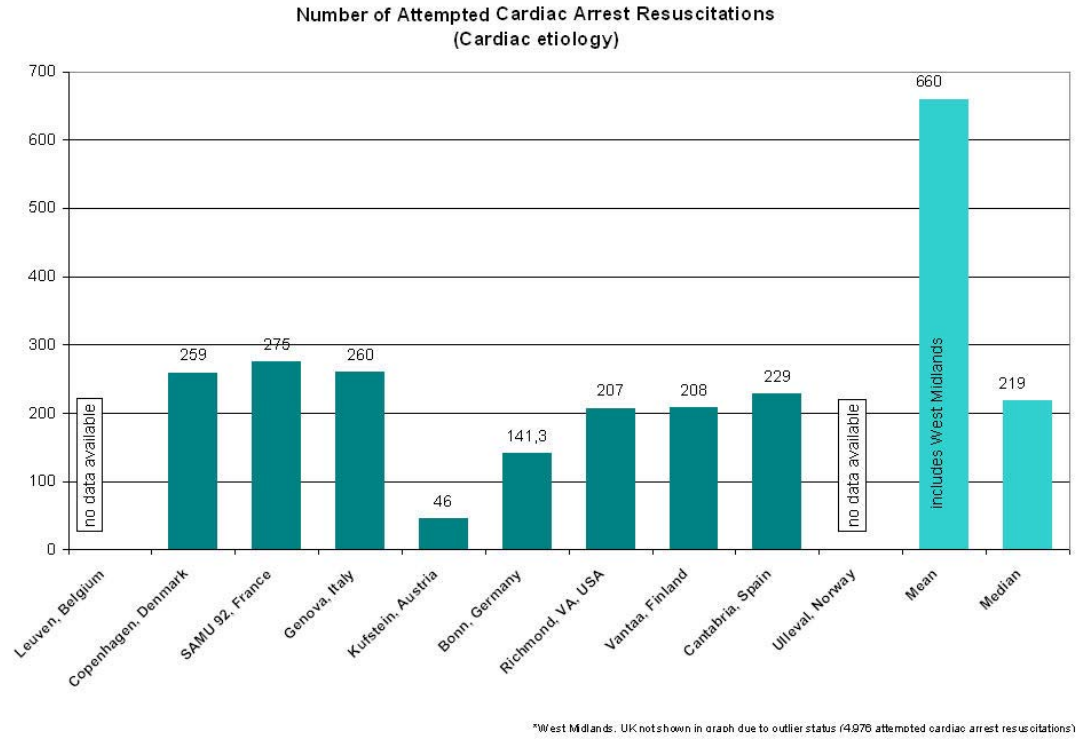


Figure 17: Number of attempted Cardiac Arrest Resuscitations

5.4 Economic Efficiency

The information reported in the three previous sections, General Information, Response Time Reliability, and Clinical Capability, has established a comprehensive foundation from which the cost effectiveness of the participating EMS systems can be benchmarked. Maintaining response time reliability, or the cost of the ability of the system to be prepared to respond, is the primary determinant of EMS system cost. Two economic measures that furnish the basis for a meaningful comparison of system costs and productivity are total system cost per patient transported and total system cost per capita.[51, 52]

To determine cost effectiveness, or economic efficiency, all system costs must be included in the analysis. In many system designs, certain component costs are readily identifiable but others are difficult to quantify. Dispatch costs and vehicle maintenance costs are examples if the functions are performed by another entity.

Determining productivity, or the system's unit hour utilization (U/UH) ratio, is the necessary first step to measuring cost per patient transported. Productivity is

calculated by dividing utilization, or the number of transports during a specified period, by the number of unit hours produced during that same period. A unit hour is defined as an ambulance either on a call or on duty during a one hour time period. The second and final step requires dividing the total cost to produce that unit hour by the U/UH, which yields the cost per transport.

The benchmarking process captured each variable to allow construction of cost per patient transported and total system cost per capita. The study calculated these two essential measurements and graphically compares the two for all systems.

[51] Overton, Stout 2002

[52] National Highway Traffic Safety Administration 1996

Total System Cost Per Capita	
EMS Systems	
System	Total (in €)
Leuven, Belgium	2.43
Copenhagen, Denmark	21.11
SAMU 92, France	3.87
Genoa, Italy	10.06
Kufstein, Austria	30,67
Bonn, Germany	19.98
Richmond, VA, USA	42.24
Vantaa, Finland	no data
Cantabria, Spain	5.53
Ulleval, Norway	31.25
West Midlands, UK	18.43
Mean	18.56
Median	19.20

Table 9: Total System Cost per Capita

Cost Per Transport	
EMS Systems	
System	**Total (in €)**
Leuven, Belgium	104.46
Copenhagen, Denmark	222.50
SAMU 92, France	93.55
Genoa, Italy	123.30
Kufstein, Austria	no data
Bonn, Germany	191.26
Richmond, VA, USA	225.42
Vantaa, Finland	no data
Cantabria, Spain	735.75
Ulleval, Norway	434.15
West Midlands, UK	174.24
Mean	256.07
Median	191.26

Table 10: Cost per Transport

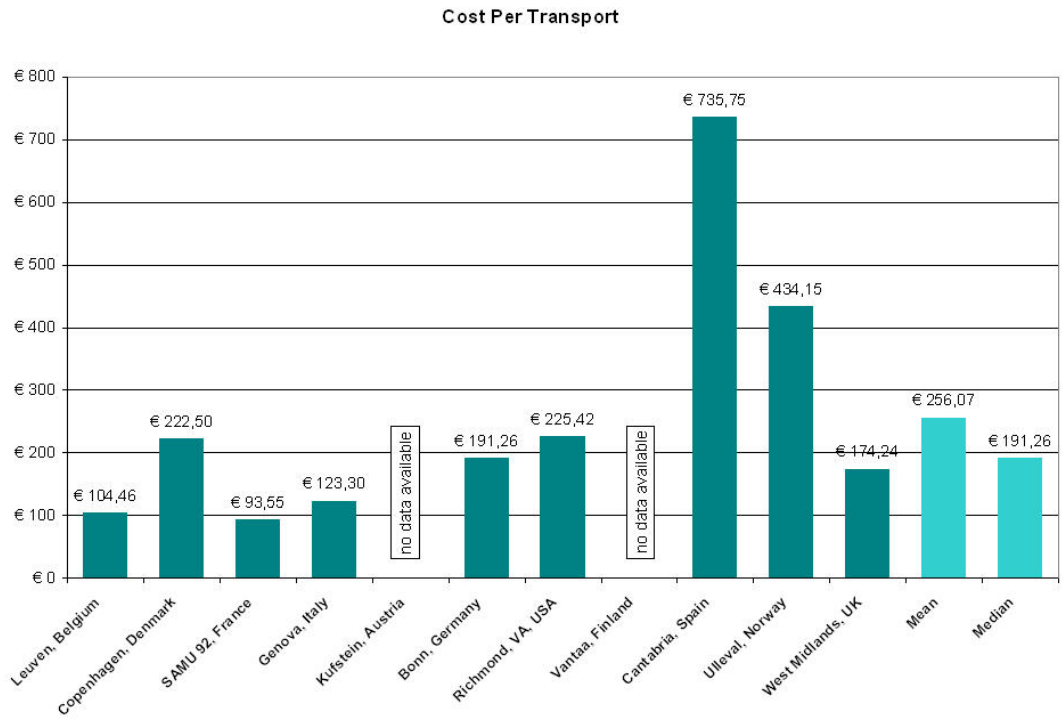


Figure 18: Cost per Transport

5.5 Summary of Benchmarking Results

Benchmarking is an established international practice to measure the performance of various governmental functions, including health care delivery. Only recently has an attempt been made to apply the practices and principles of Benchmarking to EMS. The evidence suggests that Benchmarking is applicable to European EMS systems and that sufficient basic indicators are in place to start the process.

6 Conclusions and recommendations

6.1 Conclusions

The EED project has demonstrated, that EMS are in place throughout Europe. The EMS systems have many features in common but there is no standard European system. The systems are delivered by a variety of providers and funded with different funding mechanisms.

EMS systems provide a range of services throughout Europe with considerable diversity between countries and within countries. The role of EMS is continuing to evolve and expend.

EMS systems have a gate keeping/prioritising/streaming role in many countries as a result of system diversity and the increased expectations and demand of the public.

EMS systems have to adapt to changes in provision of services in other parts of the health care system often in a reactive and unstructured way.

The lack of integration, and the lack of integrated clinical governance systems results in limited feedback and a lack of clinical governance. In order to improve the benchmarking and clinical governance, of EMS systems, in view of the volume of cases, electronic patient records for health care systems are likely to be required.

Common access pathways do not exist in Europe in spite of the EU's regulation on the common access number 112.

Skill mix for provision of EMS is provided by a range of clinicians, including physician, paramedics, EMTs and nurses.

There is no standardisation of the educational and training standards underpinning titles. For example, the length of paramedic training in Europe varies from one year to three years. The legal basis of practice is different between countries and indeed within countries.

This diversity of systems and practices has hindered the ability to identify the best practice model in the EU.

Best evidence based clinical practice is available for patient care, but is not universally adopted. There is no best evidence for logistic care and no standard solution.

There is a range of information for health monitoring. 100 potential markers were identified in use in European EMS systems although these were not common to all.

EMS should be regarded as part of health care, and EMS therefore has a critical role in the health monitoring of emergency, urgent and unscheduled care. The potential of this role has not been recognised up to this point. As the role of EMS services evolve and they become more sophisticated they become an untapped

source of health monitoring information, which, if new services are configured appropriately will provide access to vital information.

There are uniform ways of identifying certain information, e.g. Utstein template, response time (common language for some elements). The recognised templates are not universally used although they are universally applicable. An outstanding example of a clearly identified and defined indicator is the Time to First Shock in VF. This evidence-based indicator is universally applicable if adopted in all EMS systems. Some common indicators that can be applied universally were identified.

First Hour Quintet conditions were identified as potential markers, underpinned by working definitions, preferably with recognised clinical coding (e.g. ICD 9 -10).

Clinical outcomes are difficult to track beyond EMS care when the patient has been admitted to hospital or referred to another health care provider.

Across the EU, the population of individual countries have different expectations of their EMS system and as a result use EMS differently.

Across Europe, the health care systems and the social care systems are widely diverse. It is possible to describe these differences as part of health monitoring. A tool was developed to describe and begin to measure the diversity of EMS systems and the demand on those systems was produced as a template entitled "Patient Journey". The tool allowed the measurement of key stages in the patient care pathway and provided a foundation to begin the comparison of the participating EMS systems. This led directly to the development of the consensus indicators, which allows to begin the measurement of EMS systems. The logistic organisation underpinning the delivery of EMS is vitally important to the delivery of definitive care and improved outcome and survival. There was a lack of evidence and research on the logistics of effective delivery of emergency care.

No evidence has been found of the use of benchmarking practices for corporate and clinical governance. The EED project identifies the potential for the development of universal benchmarking tools applicable to European EMS systems.

The process for developing the EED project and outcomes was effective in reaching a broad based consensus amongst multiple European partners and systems. The system of workshops, partner participation and steering committee guidance was perceived by all participants as effective and equitable. The consensus view was that this method of working should be continued for future projects.

6.2 Future recommendations for European EMS

The expert group has also agreed on the following recommendations for future development of EMS in Europe:

The European Commission states that the systems of health care in the European Union and the candidate countries should face the challenge of attaining simultaneously the three-fold objective of access to care for everyone, a high level of quality in the care provided and the financial viability of health care systems.[53]

EMS systems as important part of the health care system are in place in all the countries of the European Union. There has been a steady increase in demand for delivering effective care at the point of need, fuelled perhaps by rising expectations from the European population and perhaps by the increase in the age of the population.

A basic measure of our civilisation is how we care for those who are suddenly ill or injured. European citizens should have a right to have the same standard of high quality care delivered across Europe.

The complex issues of cost-effectiveness and funding require engagement of the European public. Examples exist throughout Europe of excellent systems, which already provide a high level of care.

The EED Project has identified enormous diversity in the systems provided across the European Community. Systems of triage and prioritisation vary widely, and the methods of providing care and the standards of care provision are very different.

There is a lack of equity of emergency care across the European Community; some citizens have access to advanced levels of immediate care, while other citizens are less well served.

Much of the care that is currently provided is not evidence based and emergency medical care is a greatly under-researched area. Provisions range from centres of excellent care, delivering fully integrated ELS, BLS and ALS systems to no organised care whatsoever. Some countries have highly organised emergency care systems, which deliver intensive care to the patient at the point of illness or injury, other countries rely on rapidly evacuating patients to emergency care centres, and some countries are reliant upon General Practice to provide the first link in the chain of emergency care. New partners have joined the European Union on 1st May 2004, with new needs and varying standards of care.

In the future, it is essential to differentiate between emergency and unscheduled care, and to differentiate between the treatment and the transport role. Survival from acute life-threatening medical emergencies and acute trauma involves a chain

[53] cf. Commission Communication COM (2001) 723 final

of care. The provision of prompt emergency medical support and rapid evacuation is the second link in that chain. European citizens should expect that emergency care should be underpinned by hospitals capable of managing life-threatening medical, paediatric, obstetric and trauma emergencies on a 24-hour a day basis throughout the Community.

Agreed care pathways must exist for the management of commonly occurring emergency conditions. On line medical advice and medical governance will not only provide support to clinicians working at the scene, but will also allow the pathway of care to be planned in order for the patients to access definitive care in minimum time.

Integration with other providers in the local healthcare system is required. For emergency care services to be effective in the future, they should be part of clearly identified local care systems. Emergency care will need to focus upon the handling of genuine emergency cases and maintain a satisfactory level of response to these cases, systems must be in place for handling minor unscheduled care cases and for the management of chronic diseases. EMS should be underpinned by an infrastructure of centres providing care for the seriously ill and injured. As a minimum standard, all member states should aim to have a BLS system, providing care in urban, semi-urban and rural areas.

In the future, there is an urgent need for the development of a European prioritisation system to focus our limited resources on emergency care and to stream patients to the most appropriate provider. This system needs to be understood by all providers in the healthcare environment, in order to ensure that emergency services can appropriately refer patients to family practitioners and vice versa. Systems of emergency care must be organised to effectively provide a prioritisation and call-out procedure, an emergency response and transport to both secondary and tertiary centres.

EMS must, as a minimum, have the ability to resuscitate and support life while transporting the patient to definitive care. The next stage of the delivery of emergency medical care is to ensure that the patient is taken to the correct facility for their needs. Well-organised systems may well bypass secondary centres of care and take the patient directly to tertiary centres of care if the patient can be safely transported.

Key decisions for the future need to be made as to whether EMS focus on taking the treatment to the patient, or the patient to a definitive care centre. The emerging evidence is clearly that systems should be organised to provide immediate resuscitation in minimum time for those who have suffered life-threatening illness or injury and to transport them to centres for definitive care without delay.

European standards need to be established for the delivery of Emergency Life Support (basic CPR), BLS (CPR plus the use of an automatic external defibrillator), ALS and Advanced Trauma Life Support. The challenge for the future is to roll out, in a phased way, BLS followed by ALS and Advanced Trauma Life Support, ensuring equity of access and equality of survival chance throughout Europe.

There is little agreement on what constitutes definitive care for particular conditions within the European Community. There is variation by country of the main threats to life and a substantial variation in the range of accidents per 100,000. Taking the Quintet of life-threatening emergencies (First Hour Quintet) as defined at the European Resuscitation Council Symposium in Florence in 2002, the management of cardiac arrest, acute coronary syndromes, respiratory distress, stroke and severe trauma, varies widely across Europe. In order for EMS to be able to cope with future demand in an ageing population, the changing disease pattern and changing demographics must be modelled and planned.

The science of resuscitation once the patient has been reached is well described. The challenge for the future is to organise the logistics for care to get the clinician, or the community responder to the patient in the absolute minimum time. The key to improving survival and outcome lies in the development of effective care delivery systems. Further research needs to be focused on the logistics of minimising call to scene time while simultaneously maximising the effective use of the available resources, both clinical and fiscal.

Pan-European standards should be set for injury and accident prevention using EMS-based information on accidents and injuries to feed back to planners and legislators.

In order for EMS to provide a high level of skilled care in the pre-hospital environment, there is a need to recognise that this is a specialist area of medical practice, covering the full range of expertise, from managing emergencies in the neonate through to emergencies in the elderly. The spectrum includes the management of trauma, psychiatric, paediatric and obstetric trauma, to name but a few. European standards of training for emergency medical providers need to be established.

In view of the complexity of patients presenting, particular emphasis should be laid on the skills of patient assessment. In many circumstances, telemedicine techniques can be used to ensure that expert advice may be given to less skilled providers working in difficult circumstances.

All emergency medical systems must be monitored, audited and subject to clinical governance. The generation of accessible and accurate clinical records for each case, and access to patient records for

background information will, in the future, become essential for the delivery of effective emergency care. The way ahead for evaluating, benchmarking, research and the development of integrated clinical care records lies in the development of effective electronic clinical records, available to all participants in a broad based health care system. Thus, ensuring that each time a patient contacts the system, their previous record is available, and a new record entry is created at each contact or when the baton of care is passed.

EMS systems must be capable of supporting and sustaining a response in the event of mass casualty situations arising from new or existing diseases, and chemical, biological, nuclear or other types of terrorism with substantial reserve capacity. EMS systems must be resilient and adaptable.

In order to provide effective emergency care throughout Europe, it is essential to establish within the Community and our citizens, that there should be a basic level of public knowledge for Emergency Life Support. Emergency Life Support is not a basic minimum standard for professionally provided emergency services. The minimal acceptable standard for professionally organised services should be BLS, including the use of a defibrillator. There is therefore a need for the European Union as a society, to educate a substantial number of its citizens to provide basic Emergency Life Support/Cardio-Pulmonary Resuscitation skills.

Targets can be set to gradually improve the current European EMS standard:

1. Establishing minimum standards for European Community based care and emergency service care. (*Suggested target:* 1 in 4 of the community population trained in ELS).
2. Pan-European provision of standardised Triage / Prioritisation and Streaming, underpinned by an EMS reporting template, by 2010.
3. Pan-European emergency medical systems professionally provided to BLS and AED standards (*Target:* all professionally organised medical and fire & rescue services to be trained to BLS and AED standards).
4. Pan-European provision of ALS and advanced clinical skills for the management of trauma, to address the quintet of major killers, by 2010.

By learning the lessons of the past, by collecting the evidence from the present, we can design deliverable, cost-effective systems for the future. By answering the questions that allow us to separate demand from need, life-threatening events from minor illness and injury, defining prioritisation and gate keeping, and building a safer society, EMS can meet the needs of the citizens of Europe in the future.

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Glossary

Advanced Life Support (ALS) or Advanced Cardiac Life Support (ACLS)
Medical interventions used to treat victims of respiratory and/or cardiac emergencies and stroke, including invasive techniques such as intubation and administration of drugs. (AHA Definition)

Automated External Defibrillator (AED)
A device that has been shown in the medical literature to dramatically increases the potential for reduction of disability and death from cardiovascular emergencies. An AED rapidly analyses the electrical activity of the victim's heart to determine if a shock is needed (AHA Definition)

Basic Life Support (BLS)
Non-invasive assessments and interventions used to treat victims of respiratory and/or cardiovascular emergencies and stroke. This term has become synonymous with cardiopulmonary resuscitation (CPR) and can include automated external defibrillation (AED). (AHA Definition)

Benchmarking
Methodology to compare systems using cost efficacy indicators. Comparisons in between systems provide a useful tool for improvement.

Cardiac Arrest Situation in which a patient is unconscious, in apnoea, and no pulse is detected. Usually cardiac arrest cases are dived in witnessed cardiac arrest and unwitnessed.

Cardiopulmonary Resuscitation (CPR)
Generally refers to non-invasive assessments and interventions used to treat victims of cardiovascular and/or respiratory emergencies and stroke. This term is synonymous with BLS. (AHA Definition)

Chain of survival
Metaphorical concept that reflects the need of all the components of care to obtain a positive outcome, specifically the concepts was born for cardiac arrest patients but actually is been use in other time depend conditions like trauma or stroke.

Chest pain
Patients that complain of chest pain that suggest acute coronary conditions. (AMI, Unstable Angina)

Criteria based dispatch Predetermined systemized dispatcher interrogation protocols designed to obtain the minimum amount of information necessary to adequately establish the correct level of response and determine the need for pre-arrival instructions.

Definitive care
The physical place where the patient can receive a treatment or recommendation that solves his medical problem, without the need of other treatments for his acute problem

Discharged alive
Patients that after a cardiac arrest are discharge from hospital alive, without any consideration of the neurological situation.

Dispatch centre (Medical)
Any agency that routinely accepts calls for emergency medical assistance from public and/or that dispatches prehospital emergency medical personnel pursuant to such request.

Dispatcher
An individual that alerts an EMS unit to a call for assistance and directs it to scene.

Emergency calls
Refers to all calls that a Dispatch centre receives. Some of these calls are non-emergency calls and no response is provided. If a unit is dispatched is defined as "Response". If the response moves the patient to other facility for definitive treatment this situation is defined as "Transport"

Emergency department
An area of the hospital dedicated to offering emergency medical evaluation and initial treatment to individuals in need of emergency care.

Emergency Life Support (ELS)

The set of actions needed to keep someone alive until professional help arrives. They include performing cardiopulmonary resuscitation (CPR), dealing with choking, serious bleeding and helping someone that may be having a heart attack. (BHF Definition)

Emergency Medical Services (EMS)
A collective term describing the main agencies, personnel, and institutions involved in planning for, providing and monitoring emergency care. Frequently refers only to prehospital care.

Emergency
A combination of circumstances resulting in a need for immediate medical intervention.

EMS system
The arrangement of personnel, facilities and equipment for the effective and coordinated delivery of EMS required in the prevention and management of incidents which occur either as a result of a medical emergency or of an accident, natural disaster or similar situation.

First Hour Quintet
Group of conditions in which immediate treatment is crucial, and EMS can produce a substantial benefit. Includes: Cardiac arrest, Difficulties in breathing, Chest pain, Stroke and Severe Trauma.

Glasgow Coma Scale (GCS)
Clinical score used to evaluate the neurological situation

Highest priority response
The situation in which de dispatch centre selects a unit that can provide the higher level of care on a specific EMS, despite the unit they send.

Mainz Emergency Evaluation Score (MEES)
A clinical score specifically designed for prehospital care. Useful in medical and trauma patients

Mass casualty incidents or catastrophes
Situations in which demands of care are bigger than the resources. Usually other social structures are affected like communications, transport, security etc.

On scene time interval
Time interval from arrival to scene to depart from scene. Reflects the amount of care provide by the unit.

Paramedic
An individual trained and licensed to perform advanced life support procedures under the direction of a physician.

Response time interval
Time interval from the call is received in the dispatch centre to arrival of the ambulance on scene, specifically to patient contact. This interval reflects the System response capability.

Response
Unit mobilization to a destination as results of a call.

Return to Spontaneous Circulation (ROSC)
Situation in which a patient after receiving CPR circulation is identify by pulse confirmation.

Revascularisation
Medical technique used to reopen an obstructed coronary artery. It can be done out of the hospital using fibrinolitics, or in hospital using angioplasties.

Revised Trauma Score (RTS)
Clinical score used to evaluate trauma patients, provides probability of survival and is use to select de final destination of trauma patients.

Service area
Geographical definition of the are in which a EMS is providing service.

Severe respiratory difficulties
Patients with breathing difficulties producing clinical signs of respiratory failure.

Severe Trauma
Trauma cases with RTS equal or less than 5.

Stroke

Patients with neurological deficits including speech difficulties motor deficits and consciousness affectation.

Sudden Cardiac Death

Cessation of cardiac activity, without other warming signs, majority of cases are due to cardiac arrhythmias of which ventricular fibrillation (FV) is most frequent

System Status Management (SSM)

A computerized personal and ambulance deployment system designed to meet service demands with fewer resources and to ensure appropriated response time and vehicle location.

Time to first shock

Time interval from collapse to the delivery of first shock to patients in VF. A good indicator of system performance.

Transport

Situation in which after a response and on scene evaluation the patient is transport to other destination for definitive care.

Transport time intervals

Time intervals from depart from scene to arrival to hospital.

Triage –Supporting – System (AMPDS)

A system based on computerized that facilitates prioritisation on calls based on a structured medical questionnaire

Triage

To assign victims a priority for care and transport based on the degree of injury and the individual salvage ability in a given situation.

Unit hour

Term used to describe one staffed ambulance hour.

Unit hour utilisation

Term used to describe the number of responses done per unit hour. (Total number of responses divided per total number of unit hours)

Utstein Template

Structuring methodology to evaluate the results of cardiac arrest treatment.