



# EMERGENCY SERVICES REVIEW

A comparative review of international  
Ambulance Service best practice



## **Emergency Services Review**

### **A Comparative Review of International Ambulance Service Best Practice**

#### **Authors**

**HSR department at ScHARR University of Sheffield**  
**Dr Alastair Pickering, Clinical Lecturer in Emergency Medicine**  
**Dr Suzanne Mason, Reader in Emergency Medicine**  
**Janette Turner, Senior Research Fellow, Health Services Research**  
**Peter Bradley, Chief Executive, London Ambulance Service NHS Trust & National  
Director Ambulance Services DH**  
**Steve Irving, Executive Officer, London Ambulance Service NHS Trust**

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## **CONTENTS**

<b>Section</b>	<b>Page</b>
Introduction	1
Recommendations	2
<b>Part One: Compilation of Views from EMS Leaders</b>	
1. Methodology	3
2. Responses	4
3. Conclusion	17
4. Recommendations	19
<b>Part Two: International EMS Literature Review</b>	
5. Executive Summary	21
6. Background and search strategy	23
7. International Comparisons	24
8. Response Times	28
9. Performance Indicators	32
10. Benchmarking	38
11. Demand	42
12. Summary	46
9. Recommendations	48
Appendix 1 – Summary of Co-ordinated EMS data projects	49
Appendix 2 – Search Strategy	51
Appendix 3 – Reference List	52



# A comparative review of international Ambulance Service best practice

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## INTRODUCTION

In commissioning this study, the aim of the Emergency Services Review (2009) was to establish if there are lessons to be learned from outside the UK which, if applied in England, would help further improve performance or efficiency of ambulance services.

Part one of the review is a collection of personal views expressed by knowledgeable leaders of worldwide EMS (Emergency Medical Service) leaders and is not a survey report or data from research. The second part of this report presents the results of an academic literature review.

International comparisons of heterogenic ambulance services without context can be susceptible to misinterpretation. It is necessary to be mindful of the type of health economy that a service is part of to make really meaningful comparison. Some questions to bear in mind are:

- Is the ambulance service provided free at point of access?
- Is the service pre-paid insurance or subscription?
- Is the service funded to provide ALS or BLS?
- Is the service working in a rural health economy, 'wilderness' or dense metropolitan?
- Is it servicing a mixed demographic or an area of predominant social deprivation or wealth?

Having said this, the results of this review are interesting and are intended to provoke further debate and collaboration. There is no doubt that the international EMS community face very similar challenges, issues and opportunities.

The Emergency Services Review has produced a set of guidance and tools. The following publication is part of this series of documents. The publications are:

- A comparative review of international Ambulance Service best practice
- Good practice guide for Ambulance Services and their commissioners
- Good practice in delivering emergency care: A guide for local health communities
- System resilience: A review of NHS emergency care performance during recent winters
- Intensive support diagnostic toolkit

These publications are all available in PDF from <http://www.osha.nhs.uk>. Please contact [programmes@osha.nhs.uk](mailto:programmes@osha.nhs.uk) for hard copies or with any queries.

## RECOMMENDATIONS

### Part 1: Compilation of views from international EMS leaders

- 1) Ambulance Trusts to continue with their efforts to measure cardiac arrest survival to discharge to allow the national and international comparisons to be made in out-of-hospital resuscitation.
- 2) As the spotlight turns to trauma management, Ambulance Trusts need to ensure they are centre stage in these discussions with the new trauma networks and that their involvement forms a part of a high quality integrated regional trauma management system.
- 3) Ambulance services need to be planning now with commissioners and other health partners as to how they will deal with the possibility of the Category B target being replaced on 31 March 2011. The positive impact should be significant and planning needs to start now.
- 4) Ambulance service efforts to improve regional control room resilience need to continue and work needs to start on securing wider resilience beyond regional boundaries.
- 5) Ambulance services need to establish effective health promotion and prevention strategies with other health partners to maximise the very real opportunities that do exist within the communities they serve.

### Part 2: International best practice in emergency medical services literature review

- 6) Promote and continue involvement in international research projects aimed at benchmarking important service indicators to ensure that UK ambulance services remain at the forefront of pre-hospital care.
- 7) Continue to research and develop how elements of each of physician and paramedic led services can be adapted to accommodate changing priorities and needs and improve quality of care and value for money.
- 8) Promote international collaboration of EMS Medical Directors to identify strategies that may combat the rising demand for emergency care and improve the quality of service and care for patients.
- 9) Continue political and financial support to the evolution of the current ECP and advanced practitioner programs and expansion nationwide.
- 10) Establish a national review of computer aided dispatch software to optimise sensitivity and specificity in medical emergencies.
- 11) Ensure prospective evaluation of public health campaigns in self-empowerment and their impact in reducing ambulance use.
- 12) Develop national and local research programmes to identify the root cause of increasing demand for services and potential strategies to alleviate pressures on both ambulance trusts and emergency departments.
- 13) Promote and enhance collaboration at a local level between Primary Care, Ambulance and Hospital trusts to develop an overall programme for emergency care within a region.

Peter Bradley  
July 2009

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## **PART ONE: COMPILATION OF VIEWS FROM INTERNATIONAL EMS LEADERS**

### **1. METHODOLOGY**

- 1.1 A series of questions were sent out to contacts from around the world of Emergency Medical Services (EMS) and responses were received from New Zealand, Australia, Canada, Germany and across the USA.
- 1.2 The questions were specifically aimed at demand management initiatives, clinical quality, innovation and productivity.
- 1.3 A variety of responses were received and the key issues emerging from the answers are shown in this part of the review. The questions asked were:
- 1) Have you undertaken any initiatives to reduce demand on your services – if so have they been successful? If the answer is no, do you have anything planned?
  - 2) Can you outline the measures you use to assess the clinical quality of your service?
  - 3) What is the greatest innovation your service has introduced in the last 24 months?
  - 4) Do you have anything on the horizon that you will be doing that will have a big improvement on the performance of your service?
  - 5) Do you have anything on the horizon that will have a big improvement on the clinical quality of your service?
  - 6) Do you/have you had problems with ambulances queuing at hospitals during times of high pressure, if so is there anything you or others have done that has significantly helped to reduce this problem?
  - 7) Do you use any productivity measures in your service - if yes what are these?
  - 8) Do you have plans to improve the efficiency and effectiveness of your services – can you outline these briefly please.

#### **Compiled by:**

**Peter Bradley, CEO London Ambulance Service NHS Trust & National Director  
Ambulance Services DH**

**Steve Irving, Executive Officer, London Ambulance Service NHS Trust**

## 2. RESPONSES

**Question One: Have you undertaken any initiatives to reduce demand on your services – if so have they been successful? If the answer is no, do you have anything planned?**

- 2.1 **New Zealand** outlined their intention to develop the role of paramedic practitioner with increased scope of practice, integrated with primary care providers. This will be particularly focused in rural communities where medical support is more limited. The service has also tried (albeit unsuccessfully) to win a contract to provide an out of hours service using a practice nurse linked to the control room and emergency department (ED) able to treat, refer and prescribe.
- 2.2 **New South Wales** has undertaken an extensive public awareness campaign aimed at discouraging inappropriate use through posters, letters to GPs and community service announcements. The impact of the campaign was not directly measured and no significant variation in trends was apparent. An anecdotal view has developed amongst rural paramedics that the campaign discouraged appropriate use in some remote and rural areas.
- 2.3 Neighbouring service **Queensland** however demonstrated greatly improved public awareness following a community education campaign. Validation telephone surveys showed not only greater awareness amongst those contacted but also improved understanding of appropriate use. It is acknowledged that the reduction in demand resulting from this advertising campaign was in contradiction to many similar initiatives introduced elsewhere in the past.
- 2.4 In the USA some years ago, the city of **Chicago** tried to reduce demand by running a public messaging campaign regarding what constitutes appropriate and inappropriate calls for service. The call rate went up instead of down. Services in **Arizona** and Pinellas County, **Florida**, have decreased certain kinds of calls, i.e. paediatric drownings and elderly fractures secondary to falls, by visiting homes and identifying hazards, and instructing homeowners on how to reduce related risks.
- 2.5 It should also be noted that it can be difficult to correlate demand changes with specific initiatives as it is difficult to isolate out other influencing factors such as holiday periods, weather conditions etc.
- 2.6 **Queensland** have also introduced a 'Secondary Triage and Referral service' in its Brisbane Region Communications Centre. This service will enable specially trained clinicians to provide further clinical assessment to low acuity Triple Zero callers who may not require an emergency ambulance. Triple Zero callers who are assessed as not requiring an emergency ambulance response, but still requiring assistance with a health related issue will be provided with advice and referral options at the point of call instead of being transported to the emergency department.

## A comparative review of international Ambulance Service best practice

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- 2.7 A number of respondents highlight the benefits of using extended trained practitioners undertaking a 'see and treat' approach to less urgent emergency calls. For instance **New South Wales** stated its Clinical Assessment and Referral (CARE) scheme, which gives advanced patient assessment and training in specific clinical pathways to allow discharge from care or direct referral. They are now considering incorporating CARE training for inclusion into core paramedic training (note a paramedic in NSW is a technician in the UK and an intensive care paramedic in NSW is a paramedic in the UK). Also in NSW they have introduced Extended Care Paramedics (ECPs) who are able to provide a higher level of definitive care for low risk presentations not requiring immediate hospital attendance. ECP non-transport rates are double that of conventional crews.
- 2.8 The Canadian province of **British Columbia** reported that they are planning the roll out of Expanded Care Paramedics (based much on the UK model) to attend low acuity calls and either provide definitive care on site or organise appropriate other follow up.
- 2.9 In the Cologne region of **Germany** where the ambulance service also employs emergency doctors they are introducing a senior doctor in the control room to reduce requests for home visits that they feel are being placed by attending ambulance crews to 'cover their backs'.
- 2.10 A priority dispatch triage system has recently been introduced in Hamburg **Germany** and the further refinement of the same system is highlighted as reducing acute demand in their reply as well as from the respondents in both **North Carolina and Virginia USA**. Improvements will focus on the 'omega protocols' (lowest acuity calls) and the ability of services to provide a proportionate response to callers in the way of health advice, nurse triage etc. Being able to access community health resources is mentioned from the USA as essential to effective delivery by EMS providers.
- 2.11 'Health advice' is detailed from various services as the preferred method for dealing with less urgent emergency calls. Whether hosting or transferring callers to another agency, the use of paramedics and nurses to resolve emergency calls (without attending the patient) is now much more frequent.
- 2.12 Technological initiatives reported include a Patient Distribution System (PDS) from **Toronto**. This programme was developed in house and installed in all emergency departments. PDS identifies the hospital with the resources best able to meet the needs of the patient, based on their CTAS level (Canadian Triage Acuity Scale) and promotes equitable distribution of EMS patients across the City's emergency departments, based on time, distance and volume.
- 2.13 An 'ambulance arrivals board' is currently being looked at for possible implementation in **Queensland** Health hospitals. This real time feed of data from the Emergency Services Computer Aided Dispatch (ESCAD) system, which enables hospitals to view the current status of ambulance vehicles en route to, or at emergency departments.

**Question Two: Can you outline the measures you use to assess the clinical quality of your service?**

- 2.14 The response from **New Zealand** highlighted the use of their cardiac arrest database which allows them to measure cardiac arrest to discharge survival rates using the Utstein template. The Utstein template is perhaps the only standard to achieve recognition and acceptance across international pre-hospital care.
- 2.15 **Toronto** along with some other services use an electronic patient report form allowing quicker and more efficient data analysis of many parameters including clinical skill usage, responses to advanced life support (ALS), conformity with guidelines etc.
- 2.16 **Queensland** reports on the development of an extensive clinical audit review tool (CART). This software program was developed to assist in managing the review of cases on a state wide basis and supported early identification and review of high risk cases. CART application has demonstrated its ability to assist in the recognition of clinical competence in both the education and clinical advancement paradigm and, has been implemented at regional and state level. This tool forms the basis for a more robust clinical governance process for all Queensland paramedics by:
- randomly selecting a percentage of all QAS clinical interventions for review (sourced from the electronic ambulance report form data warehouse)
  - automatically highlighting high risk cases within 24 hours of synchronisation of the electronic ambulance report form tablet PC
  - enabling open and transparent engagement with paramedics to review the standard of care provided
  - identifying opportunities for improving patient care and improvements in clinical practices
- 2.17 Other respondents also reported an audit focus on cardiac arrest and STEMI patients. For trauma care in **New Zealand**, in conjunction with the Trauma Coordinator for Auckland Hospital, the clinical standards staff from the ambulance service are able to follow up on major trauma patients and feedback patient outcomes to ambulance staff.

## A comparative review of international Ambulance Service best practice

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2.18 Across the responses from **American** providers there is extensive use of Clinical Performance Indicators (CPIs), particularly focused on invasive procedures (airway and circulatory) and drug usage. Some of the services recognise that they lag behind in this area and can only provide audit on a few select parameters. At the other end of the spectrum the **City of Houston** report extensive activity and have several full-time CQI staff that perform a variety of functions:

- 100% review of all cardiac arrest data (chart review, AED and ECG downloads, voice communication, etc.) with multiple objective parameter measures. Select cases are then reviewed in detail with field crews and they hope is to expand this to >50% detailed review with the crews
- 100% telephone follow up with all non-transported and 10% follow-up with transported patients to get customer feedback as well as to detect any systemic clinical problems
- Up to 4 full-time EMS MD's and one part-time EM MD that provide all on-line medical oversight and respond to any emergency to which they are summoned to (at the request of field personnel) and ad hoc when on call

2.19 In Charlotte, **North Carolina** a company is contracted to poll recent patients each month. The questions pertain to patients' perception of employees' skills, the tools utilised, and their ability to explain what care they are delivering to a given patient. It is felt to be an important measure of how the community feels about the clinical care provided, and the service values identifying areas where it can continue to train employees and improve overall patient satisfaction.

2.20 An assessment of decision making by tracking the percentage of 'non-conveyed' patients who then present at hospital within 24 hours is another tool mentioned from the **USA**.

2.21 The final common thread from a variety of respondents was the use of complaints as a tool for assessment of clinical quality. Although no service reports on having joined all feedback mechanisms under a 'patient experiences banner', early experience in the NHS seems to indicate the improved benefits of this approach.

### **Question Three: What is the greatest innovation your service has introduced in the last 24 months?**

2.22 **New Zealand** highlighted the recent introduction of a bariatric ambulance on trial basis for the transportation of obese patients. They also highlighted the reduction in the number of communications centres nationally to three (from 12), all are now linked and this has significantly improved resilience and call handling capability across the country.

## A comparative review of international Ambulance Service best practice

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- 2.23 **New South Wales** details two particular areas – the appointment of a Pharmacist who has contributed significant benefits relating to clinical practice and service efficiencies and a major staff welfare initiative. Their Healthy Workplace Programme is designed to improve staff morale and workplace culture by reducing bullying and harassment in the workplace and to deal more effectively with those behaviours if they occur. The Healthy Workplace Programme has included the appointment of a dedicated senior role, *Manager, Healthy Workplace Strategies*, who is responsible for coordinating systems to manage and monitor the resolution of staff grievances, complaints and workplace conflict and to ensure that the strategies comply with relevant legislative requirements and **New South Wales** health policy. A *Respectful Workplace* training programme is a major component of the overall strategy with all 4000 staff trained over 12 months in simple techniques for raising and responding to concerns about workplace behaviours. To compliment the training of all staff a specific formal management development course has been created called the *Ambulance Management Qualification*. This course is compulsory for the first 3 levels of frontline management, i.e. Team Leaders, Station Managers and District Managers. The course covers operational and clinical responsibilities and has a strong staff management and healthy workplace focus.
- 2.24 **Queensland** emphasise the importance of Regional Performance Reviews introduced across the service in the last 24 months. The establishment of clear and defined key priority areas encourage an integrated approach to operational and strategic planning, budgeting, human resource management, client service and reporting cycles which assists in aligning the organisation to achieve operational and strategic objectives.
- 2.25 Across the **USA** there has been some good progress reported on the planning some EMS agencies are doing together with their regional health departments and emergency management agencies around questions of how to respond to issues such as H1N1 without adequate resources.
- 2.26 **Toronto** EMS use an innovative job share approach to help reduce delays in turnaround at hospital. The hospital employs a registered nurse dedicated to the EMS who pay for their time. Their function in the ED is to assume care of up to 5 lower acuity EMS patients who would otherwise be in offload delay, freeing up paramedic resources. This has been very successful in improving unit availability e.g. in March 2009, 112 UH (Unit Hours) gained over the same period in March 2008, returning the equivalent of 10 ambulances to the system.
- 2.27 Clinical improvements are detailed by many respondents which reaffirms that patients are at the focus of the services delivered. Particular mention is given to improvements for cardiac patients with continuous chest compressions in CPR being mentioned and the redirection of STEMI patients direct from the field to Cath Labs for angioplasty (**British Columbia**).

**Question Four: Do you have anything on the horizon that you will be doing that will have a big impact on the performance of your service?**

- 2.28 Responses from the **USA** mention that increasing financial constraints are perhaps hindering some big initiatives and one comment was to 'yank EMS out of Fire departments' to reduce conflicts over budgets, leadership and organisation.
- 2.29 **North Carolina's** Medic system has tailored their response to better meet the need with a new EMS System Model Design. The Medic leadership team is looking at alternative deployment models that can help ensure that the right resource is sent to the right scene every time. Not everyone requires a paramedic team in order to meet their needs, so they are evaluating various tiered response models to see what might allow them to better use their resources and improve overall patient care. This is still in the development stages and modelling will need to be done to see potential impact and costs associated with the various approaches being evaluated.
- 2.30 **Queensland** are anticipating significant benefit from their state-wide restructuring and are also introducing Secondary Treatment and Referral (STAR) in the Brisbane regional communications centre that will enable the further triage of low acuity calls by suitably trained clinicians offering advice and referral where appropriate. The introduction of vehicles with bariatric capability and extra training and equipment for staff is expected to deliver benefits to staff and patients. **New South Wales** also hope to gain benefits from restructuring services and improving its rostering arrangements to better meet demand. NSW has made a significant investment in an Ambulance Electronic Patient Record (AERP). The project will deliver high-quality health care services by giving paramedics access to the most up-to-date protocols, pharmacologies and clinical procedures on the road. Information collected will help build national data sets for use in research, national collaborations and the health surveillance networks and at the same time build up case history on patients and automate the flow of information between ambulances and hospitals.
- 2.31 **New Zealand** highlighted two areas, firstly the use of a demand and resource modelling software (Siren) to improve rostering and resource deployment nationally. Secondly, following a review of their ambulance communications network a number of recommendations including the need for more flexible rostering and more equitable distribution of calls across their dispatch desks is planned.
- 2.32 **New York City** report on improvements to automated vehicle locations systems, and the introduction of a computerised scenario based deployment and re-deployment system.

## A comparative review of international Ambulance Service best practice

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- 2.33 **Toronto** now has the ability to establish its own response time standards. Standards for cardiac arrest and CTAS Level 1 patients will be pre-established by the medical authority of the province, but the compliance rates will be left to each service. For all other levels of medical acuity, the response time standards will be theirs to set. It will allow them to match reasonable response time standards against their operational experience and clinical data. Response time performance for individual classes of calls and overall system performance will improve. There will also be secondary system benefits: reduced overtime payments, reduced end-of-shift overtime, improved meal break compliance and therefore reduced costs.
- 2.34 Within the **German (Cologne)** EMS system, ambulance companies have to re-tender for contracts every four years and the requirements for staff education are being increased with a direct aim of improving quality of services. **Hamburg** similarly mentions extension of the paramedic training programme from 2 to 3 years.

### Question Five: Do you have anything on the horizon that will have a big improvement on the clinical quality of your service?

- 2.35 **Toronto** has successfully adopted a direct admission policy to cardiac catheterisation centres for STEMI patients – bypassing the emergency departments and with over 700 patients benefiting over the last year.
- 2.36 **US** services report on a variety of clinical interventions that are being introduced or trialled. Most mentioned are automated compression devices for use during CPR; different airway adjuncts (King airway similar to a laryngeal mask) and CPAP (constant positive airway pressure) adjuncts. Hypothermic treatments in resuscitation are also being trialled and evaluated and are particularly mentioned by numerous providers as yielding very positive results for patient outcomes. Richmond EMS in **Virginia** are particularly detailed in describing their Richmond Induced Cooling Protocol by EMS (RICE) and associated 40% survival rate for these patients.
- 2.37 **New Zealand** highlighted two key future developments, the introduction of Clinical Performance Indicators (CPIs) and the Electronic Patient Report Form which will be used in part to improve clinical audit processes and clinical guidance. Other services also highlight the move to ePRF as significant including **British Columbia** and **Miami**.
- 2.38 An increased focus on research and clinical trials is highlighted from various respondents – directly linked to improved clinical outcomes. **Queensland** in particular is investing in a significant programme and is a partner in the Australian Centre for Pre-hospital Research.
- 2.39 Trauma care in **New South Wales** has been updated and a decision made to use experienced paramedics to monitor all incoming emergencies across the State to activate a helicopter response and notify receiving hospitals for all serious trauma cases.



## A comparative review of international Ambulance Service best practice

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- 2.40 **Queensland** are strengthening their clinical ability by appointing a specialist senior Doctor as an assistant to their medical director. They also intend to introduce a portable ultra-sound capability for serious trauma field assessment and an advanced intra-osseous adjunct.
- 2.41 **North Carolina** report on investing in a state of the art simulation training centre designed to combine classroom training with clinical application in the most realistic environment possible, confident of improving patient outcomes.

**Question Six: Do you/have you had problems with ambulances queuing at hospitals during times of high pressure, if so is there anything you or others have done that has significantly helped to reduce this problem?**

- 2.42 **New Zealand** outlined problems they encountered last winter of ten ambulances queuing at one hospital for up to two hours. Actions to reduce this problem have focused on off loading patients in ambulance bays onto portable stretchers and leaving patients (non life threatened) in the care of one ambulance clinician. A threshold of 40 minutes has been set before initiating this action and the service reports an improvement in turnarounds as a result.
- 2.43 The problems associated with queuing at hospital emergency departments have been a long standing challenge for **Ambulance Service New South Wales**. A number of solutions have been implemented to reduce the impact of queuing. In 2004 a whole of health approach was adopted and extensive redesign projects were implemented at individual hospitals. These projects had as a core value the fact that queuing is a problem for the whole hospital not just the ED involved. It required a whole review of the patient journey as opposed to simply focussing on ambulance and emergency departments. In 2006 the Ambulance Service introduced the Patient Allocation Matrix which electronically advises responding ambulance crews of the next most appropriate ED based on the clinical presentation of the patient. Each emergency department has a pre-modelled patient threshold which is constantly monitored through the ambulance CAD to determine when to turn off or on future ambulance presentations. The system is of great assistance in distributing workload more evenly across the emergency department network at peak times. It delivered significant improvements on earlier systems that allowed hospitals to divert ambulances from EDs when overwhelmed by presentations. Unfortunately, subsequent demand increases and changes to key hospital staff have seen unload times deteriorate with only 67% of ambulance patients handed over within 30 minutes.

## A comparative review of international Ambulance Service best practice

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2.44 **Queensland** report ambulance queuing, otherwise known as access block, at emergency departments as an increasing phenomenon across Australian states and territories, as it is becoming internationally. In the busier urban regions in the south eastern corner of the state of Queensland there is higher demand and larger population bases, which has a greater impact on emergency response time performance when ambulances are ramped and unable to hand-over patients. At four major hospital emergency departments across the south eastern corner of the state of Queensland a new role is being trialled to improve the supervision of paramedics and liaison with hospital Department of Emergency Medicine management to monitor emergency department access block. The key performance indicator used to monitor emergency department access block will be the difference between the ambulance arrival at the hospital and the time the patient is off the QAS stretcher. This data is collected electronically using the Mobile Data Terminal in each ambulance linked to the Emergency Services Computer Aided Dispatch (ESCAD – Tri Tech) system (arrival time) and the electronic Ambulance Report Form (eARF) (off stretcher time). Hospital capacity alerts that can inform the Regional Communications Centre are electronically advised to the QAS. This enables the Clinical Deployment Supervisor operating within the emergency ambulance communications centre to monitor patients heading toward a hospital emergency department where the ambulance may be queued and redirect the crew if clinically appropriate to do so. QAS and Queensland Health are also looking to implement an Ambulance Arrivals Board system in certain emergency departments that will ensure hospitals are made aware of what ambulances are arriving at the ED and what the patient status is prior to arrival.

2.45 Historically, hospital closures in **Toronto** have impacted on patient flow and ED resources resulting in long drives to find a hospital willing to accept a patient. Once at an ED, the transfer-of-care times could be long, with diagnostics performed on EMS stretchers both within and outside the ED (X-ray, CT). This resulted in decreased unit availability to the community, negatively impacted response time (1997: 90% met 8:59 minute target; 2006: 67% met 8:59 minute target) and created labour issues around missed meal breaks, end of shift overtime and frustration over loss of in-station time, etc. The issue has been managed by:

- Operations supervisors were sent into EDs to manage offload delay by doubling up patients with crews and liaising/negotiating with ED staff to decrease transfer-of-care times
- At the senior management level, active discussions were had at the level of hospital CEOs to acknowledge the issue and create relationships that would promote solutions to ED wait-times and patient flow issues throughout hospitals
- Policies developed through a committee that included physician, paramedic and Toronto EMS management to provide direction to ED staff and paramedics regarding the off-loading of low acuity patients in the ED.

## A comparative review of international Ambulance Service best practice

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2.46 **British Columbia** reported significant problems with hundreds of lost unit hours on some days and has used a number of initiatives including:

- Invoicing the hospital for standby rates - crews get 30 minutes to offload. After that the crew calls in to control and get a new response number and we then bill. Yes, the hospitals are paying and yes, it has had an effect. Better in some hospitals than in others but overall we're definitely in better shape
- Using a field supervisor whose sole job is to deal with offload delays. They travel the region checking up on the EDs, attending hospital bed meetings, helping trouble shoot any issues etc. The Supervisors undertaking this role have built good relationships with the hospital access managers, ED charge nurses RN's etc and are able to really help 'grease the wheels'

2.47 **Dallas** also utilise a financial incentive to ease the problem of ambulances 'ramping'. A programme was implemented through which any ED at which three or more ambulances are delayed are put on "redirection". When this occurs, other ambulances are recommended to other hospitals and only with senior approval (which is infrequent) may patients be brought to those facilities until ambulances have cleared from that ED. The potential loss of paying, well-insured, established patients caught the attention of most hospitals, and many have implemented very formal plans to address the issue on a daily basis. This was initially done with the "worst offenders" and then expanded to all hospitals.

2.48 The **German** (Cologne) response indicates that the ambulance service's medical director is the final arbiter of where a patient should be taken in the event of hospitals being busy. The ambulance service will also help hospitals free beds with inter-hospital discharges and there are also clear boundaries of where hospitals will receive patients from.

2.49 **Charlotte North Carolina** report on collaborative working with receiving hospitals and the application of LEAN principles and 6 Sigma processes to ease patient flows.

2.50 In **Miami** the problem has receded since they developed a system for hospital diversion (with strict ground rules). An EMS officer can freely override a hospital diversion request as needed. Data tracking and distribution of spreadsheet showing every hospitals' diversion hours to all hospital CEOs, and group hospital meetings all help deal with the issue. It is now very rare to have ambulance turnaround times of over 20 minutes, usually much less. In **Portland, Oregon** they only had sporadic outbreaks of this issue having approached their partner hospitals, their leverage is that if the situation is NOT corrected they will stop taking ambulance patients to that hospital. However, this strategy only works if there is another hospital close by. **Phoenix Arizona** reported to have had major problems with this in the past, however, since they began tracking transfer of care times at hospitals and going to the CEOs at the problem hospitals to tell them that prolonged "wall times" were unacceptable, they have seen a significant decrease in the problem.

**Question Seven: Do you use any productivity measures in your service - if yes what are these?**

- 2.51 Across the **USA** there appears a greater common understanding of Unit Hour Utilisation (UHU) – understandable perhaps when costs are crucial to survivability of providers. A figure of 0.39 for transport UHU is quoted as the requirement to ensure financial balance. Productivity measures also feed many parameters required to run the high performing services utilising system status management regimes. With activation ('out of chute') on scene, arrival, post-to-post and turn round times all being routinely collected.
- 2.52 A unique item reported from **Richmond Virginia** relates to safety and is linked to productivity. Data is gathered on driving and driver via a 'Road Safety' black box recorder. Data includes unsafe reversing, over and under force scores, miles driven both routinely and emergency which are then published as a league table for employees. In the UK, it is said, reversing accidents are more prevalent than in forward gear – in Richmond Virginia they have no episodes.
- 2.53 In **Germany**, there are no productivity measures as such but a comparison between the workloads of the different providers to give a rough estimate of productivity.
- 2.54 Ambulance services across **Australia** report information on response times in the Commonwealth Government's Report on Government Services (ROGS). **New South Wales** responded that it sets performance targets for operations including; 50<sup>th</sup> and 90<sup>th</sup> percentile response times, percentage of booked transports arriving within 30 minutes, activation time (i.e. the time the first vehicle is assigned, less the time in the dispatch queue) and the average time a case is in the dispatch queue.
- 2.55 In **New Zealand** the increased national focus on ambulance service performance is drawing comparisons between districts and regions and they expect to further enhance efficiency and performance improvement through the use of computer modelling. Currently NZ measure activation times, responses to high priority calls, on scene times and job cycle time.
- 2.56 **Toronto**'s current key performance indicators include the typical EMS measures of response time components by incident priority. Emergency incidents are separated into 8 categories based on the Medical Priority Dispatch System (MPDS), each with a performance guideline.

## A comparative review of international Ambulance Service best practice

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2.57 New government mandated response time standards are being introduced for the most acute patients based on presenting acuity on paramedic arrival. This requires very accurate classification of incidents during call receiving to ensure that call classification is predictive of patient acuity. **Toronto EMS** is conducting in-house research on approximately 250,000 patient care records to determine which of the ~1,300 MPDS determinants produce patients in the Cardiac Arrest and CTAS 1 categories. The performance standard for the dispatch time component of the overall response time will be mandated at 2 minutes for patients found to be CTAS 1 or in Cardiac Arrest. This will include call taking, prioritisation and unit assignment decision making. Toronto EMS is currently working to establish appropriate response time standards for all other patient acuity standards that respect and balance patient clinical need and customer expectations.

### **Question Eight: Do you have plans to improve the efficiency and effectiveness of your services – can you outline these briefly?**

- 2.58 **New South Wales's** operation centres are about to undergo major technology, work practice and industrial reform. Upgrades to the CAD system will establish a single virtual call taking and dispatch platform across the 4 centres in NSW by the end of 2009 and a new industrial agreement is due to be completed by July 2009. A major goal is to standardise practices to improve call handling times and to increase the status (and skill base and remuneration) of operations centre staff.
- 2.59 **New Zealand** highlighted the issue of bringing a much stronger focus to the use and application of operational KPIs where there was (in their own words) – ‘much room for improvement’.
- 2.60 New Zealand also highlighted rostering as an issue, particularly the use of 12 hour shifts where very early starts coupled with late finishes means that staff can be at work for 13-14 hours a day. This is viewed as too long by some and the service is looking to supplement the 12 hour rosters with some shorter shift patterns.
- 2.61 **Toronto's** plans include: New Model of Care: Redefinition of response configurations for emergency calls to better match ALS units to patients requiring ALS, and basic life support (BLS) units to lower acuity patients. Local clinical evidence is being used to redefine the response to each of the Medical Priority Dispatch System's (MPDS) more than 700 “determinants”:
- Changes to response time measurements (Q4)
  - Communications Centre (CACC) Redesign (Q3)
  - Scheduling consultant review process – would allow Toronto EMS to roster staff to better meet demand rather than using the current scheduling pattern which has been in place since 1975 and no longer meets our needs

## A comparative review of international Ambulance Service best practice

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- 2.62 **Queensland** is in the process of outfitting all ambulance vehicles with satellite navigation systems. These devices are aimed to be a supplementary tool for paramedics to use to accurately reach their destinations in a timely fashion. In addition, experienced paramedics (designated Clinical Deployment Supervisors or CDSs) commenced work in the Brisbane and South Eastern Region's communications centres on 9 June 2008. The CDSs provide enhanced clinical input at the point of call into decisions about dispatching resources such as determining whether an emergency ambulance is necessary and ensuring effective use of specialist resources, such as Intensive Care Paramedics. For the Brisbane Region there has been a reduction in the response to incident ratio such that for the first two weeks of July 2008 the response to incident ratio was 1.14 compared with 1.40 for the month of July 2007. The response to incident ratio relates to use of resources, and indicates numbers of ambulances dispatched per incident.
- 2.63 In addition the Medical Priority Dispatch System has been reviewed to ensure appropriate resources are dispatched to incidents and that response to incident ratios meet national standards. The changes to dispatching protocols together with the introduction of CDSs have resulted in a reduction in the response to incident ratio for Queensland. The national average as reported in the 2009 Report on Government Services (ROGS) was 1.24; QAS state wide is currently averaging less than 1.20 for the first nine months of the 2008/2009 financial year. QAS will continue to monitor performance against the national average. Finally from Queensland, a strategy is being developed which will be aimed at providing a blueprint for staff professional development. In the case of QAS it is acknowledged that the provision of clinical education was of a high standard. However, it has also been identified that a stronger emphasis needed to be given to leadership and management education, gender sensitive programmes and tools for self assessment. It will be aimed, through a holistic approach, to build a stronger leadership and management capacity within the service and provide a larger pool of potential applicants for future advancement as opportunities arise.
- 2.64 A final comment from the **USA** highlights another significant influencing factor on improving the EMS system in that there is increasingly a movement toward requirements for university-level education and training amongst American ambulance service personnel. In addition, educating and training EMS managers in the science and art of managing such services at the university level is also believed to deliver significant system benefits. It is also the case that the training of more EMS providers to also become qualified researchers ensures that the "doers" can also participate in illuminating and solving problems related to the provision of out-of-hospital emergency care.

### 3. CONCLUSIONS

- 3.1 Lessons can always be learnt and this brief comparison shows services around the globe attempting to deal with common issues in a variety of ways. It is interesting to see how many problems are actually shared across EMS and how similar many of the solutions are.
- 3.2 It is clear from what we know and from the responses we received that there is no quick fix to reducing demand on ambulance services and some services even report an increase in demand following their public education campaigns. What is clear is that well targeted campaigns can raise awareness on the role of the ambulance service; however this must be done as part of wider local health communications plan. Two of the US responses talk about targeting public awareness at specific patient groups including elderly fallers which makes sense. They also talk about health promotion and prevention in the home. This is a huge untapped area in the ambulance service, where we have thousands of our staff going into tens of thousands of people's houses every day. We need to consider how we get best use of this fantastic opportunity to share key health messages with the public.
- 3.3 This will become even more important as the three digit number pilots roll out and as efforts continue to find suitable clinical indicator and outcome measures for Category B calls, thus removing the need to send an ambulance automatically to up to 50% of our demand. When the public dial 999 and ask for an ambulance they expect one, every time. The fact that increasingly this will not be happening needs to be communicated to the public in a clear, simple and reassuring way.
- 3.4 The ambulance review of 2005 had a heavy focus on 'see and treat' and 'hear and treat' for those patients that could more appropriately be dealt with outside hospital. It could be argued that as a result of this focus, some of the emphasis and profile of the smaller but nonetheless very important group of life threatened patients have not had quite the attention they should have had from a management perspective. Responses to the questions (particularly from the US) are a timely reminder of the importance of high quality resuscitation both in terms of the focus it receives within our organisations, innovative practice and measuring success within our services and across England. Furthermore, whilst beyond the remit of responses, we know we can learn from others in terms of how trauma is managed in the pre-hospital environment from other parts of the world - parts of the US and Australasia spring to mind. We need to build this learning into our planning for trauma management going forward, I am aware that some services already are.

## A comparative review of international Ambulance Service best practice

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- 3.5 Since the ambulance service mergers in England a lot of work has been undertaken to improve the resilience of ambulance control rooms both in terms of technology, load sharing and staffing during periods of high demand. This work needs to continue at pace within individual ambulance trusts and work should also be started to look further at improving resilience beyond regional boundaries to reduce the reliance on non health related organisations. The example given from New Zealand shows the progress they have made in significantly improving ambulance control room resilience both regionally and nationally, and illustrates there are lessons for us here.
- 3.6 Hospital turnaround problems are clearly an issue, at times, for ambulance services across the world. The initiatives outlined in the responses do not represent anything new in terms of approach. However, it is fair to say that it is unlikely that all ambulance services are doing everything outlined in the responses, either well or all of the time. It would be worthwhile ahead of winter (and I am sure this is happening in any case) for all ambulance trusts to review each of the responses in this document and assure themselves they have robust plans in place for each element. This includes real time capacity monitoring and management; comprehensive divert policies; clinical off load arrangements that are not wholly dependent on whether the ED has space and 24/7 management support.
- 3.7 The use of the electronic patient report form is slowly being rolled out across ambulance services in England. The responses from services in other parts of the world remind us of the added benefits that can be achieved (beyond getting rid of the form filling!) from such systems. Improvements in clinical audit and governance are just two, as is the opportunity for ambulance clinicians to have greater visibility of the care they have been providing over the longer run.



#### **4. RECOMMENDATIONS**

- 1) Ambulance Trusts to continue with their efforts to measure cardiac arrest survival to discharge to allow the national and international comparisons to be made in out-of-hospital resuscitation.
- 2) As the spotlight turns to trauma management, Ambulance Trusts need to ensure they are centre stage in these discussions with the new trauma networks and that their involvement forms a part of a high quality integrated regional trauma management system.
- 3) Ambulance services need to be planning now with commissioners and other health partners as to how they will deal with the possibility of the Category B target being replaced on 31 March 2011. The positive impact should be significant and planning needs to start now.
- 4) Ambulance service efforts to improve regional control room resilience need to continue and work needs to start on securing wider resilience beyond regional boundaries.
- 5) Ambulance services need to establish effective health promotion and prevention strategies with other health partners to maximise the very real opportunities that do exist within the communities they serve.

## 5. ACKNOWLEDGEMENTS

- 5.1 Thanks go to all who took the time to provide answers to the brief questionnaire in particular the leads from services in Queensland, New South Wales, New Zealand, Toronto, British Columbia, North Carolina, Virginia, New York, Cologne, Hamburg and all those medical directors of EMS across the USA known collectively as 'the Eagles'. Special thanks also to Jerry Overton and Rick Bissell for their astute comments and observations.

## **PART TWO: INTERNATIONAL BEST PRACTICE IN EMERGENCY MEDICAL SERVICES LITERATURE REVIEW**

### **6. EXECUTIVE SUMMARY**

- 6.1 In order to establish if there are any lessons to be learnt from outside the UK that may help improve ambulance service performance, a focused literature review and web based search was performed. The areas of focus were:
- International comparisons of EMS systems
  - Response Time targets for high-performing systems
  - Performance indicators and benchmarking of service provision
  - Strategies to monitor and manage increased demand.
- 6.2 International collaborations have been established over the past few years in order to address the issue that EMS systems across the world are not directly comparable. These groups have established an initial series of benchmarks, hopefully to be expanded, by which different systems can be directly compared, with the objective of stimulating collaborative and high quality research in the field of pre-hospital medicine.
- 6.3 The current evidence base is sparse with the most convincing evidence for the benefit of pre-hospital care being the ability to provide defibrillation and advanced life support as quickly as possible to those in need. This led to a focus on response time targets, which vary greatly across the developed world.
- 6.4 Current systems are now moving away from a single target focus and expanding the set of performance indicators against which they will be assessed, at a regional, national and international level. The Joint Royal Colleges Ambulance Liaison Committee (JRCALC) clinical practice guidelines and the indicators developed from those are being adapted in other countries for local use, with the US systems attempting to develop a national strategy for their heterogeneous EMS healthcare provision.
- 6.5 A notable benefit from the drive to reach patients as quickly as possible with stringent targets has been the development of technology to enable better communication between teams in the field and control centres or specialist care services.
- 6.6 New working practices have been developed with the introduction of first responders, emergency care practitioners and some pre-hospital physicians all proving beneficial from a patient care perspective. The UK is leading the way in the development of emergency care practitioners, under medical leadership, in order to deliver healthcare directly to the patient – often avoiding the need for transport to hospital.

## A comparative review of international Ambulance Service best practice

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- 6.7 Issues around the increasing demand for emergency medical services have been discussed in the literature for many years but there remains little prospective research into actively reducing such need. Strategies to manage demand in the UK have developed, such as clinical telephone advice via NHS Direct or in ambulance control rooms and community practitioner roles, but more stringent quality assessment is required, in particular to the computer software that generates the currently used clinical categories.
- 6.8 These strategies are similar to the physician led triage and dispatch service in parts of Europe, but more healthcare community involvement is required to establish the success of such services.
- 6.9 Overall, the UK ambulance service provides a technologically advanced and efficient service when compared to others from around the world. Until more direct comparisons are possible between systems and high quality research is forthcoming, there is little evidence to prove/advocate that change will improve the care provided.

**Dr Alastair Pickering, Clinical Lecturer in Emergency Medicine**  
**Dr Suzanne Mason, Reader in Emergency Medicine**  
**Janette Turner, Senior Research Fellow, Health Services Research**

**July 2009**

## 7. BACKGROUND AND SEARCH STRATEGY

- 7.1 Following a period of unprecedented service demand and a drop in performance regarding ambulance service targets at the end of 2008, the Office of Strategic Health Authorities asked for a report to compare emergency medical service (EMS) practice in the United Kingdom (UK) to other services on an international platform. The aim of this literature review was to establish if there were any lessons to be learnt from outside the UK that, if applied in England, would help improve either performance, quality of care or efficiency and effectiveness.
- 7.2 A rapid evidence assessment was performed searching mainstream databases. A separate web-based search was performed to identify regional performance indicators for each ambulance/emergency medical service thought to be of relevance to the outline of this review. Once identified, the evidence base for these indicators was then reviewed and compared to those used in the UK.

### Remit

- 7.3 Within the short time frame required for this piece of work a systematic review of the literature was restricted and following consultation it was agreed that the search would focus on four main areas in order to achieve its goals. These are listed below:

- International Comparison
  - Direct
  - Indirect
- Response Time targets

Within the search for evidence relating to response time targets it was agreed to focus on high-performing EMS systems as a scoping review of other countries had demonstrated considerably poorer response rates to life-threatening emergencies. High performing EMS systems were considered to exist in four main geographical regions:

- United Kingdom
  - Europe
  - North America (USA/Canada)
  - Australasia (Australia/New Zealand)
- Performance Indicators
    - Evidence base
  - Demand management strategies

## 8. INTERNATIONAL COMPARISONS

### Direct

- 8.1 The literature search identified very few articles that directly compared different international pre-hospital healthcare, or EMS systems. A number of descriptive articles and project studies were identified that highlighted the differences between various systems and the call for more unified reporting of structures and outcomes was frequent in order to enable direct comparisons between countries<sup>[1,2]</sup>. Steps towards this have been taken in Europe, with the publication of the European Emergency Data project<sup>[3]</sup> and the Hesculaep project<sup>[4]</sup>, and in the US with the publication of the Coalition of Advanced Emergency Medical Systems (CAEMS)<sup>[5]</sup>, but no substantial comparative data have, as yet, been reported (see Appendix 1).
- 8.2 Comparison of data from patients suffering cardiac arrest had formerly suffered from similar problems with the lack of unified definitions of conditions and outcomes. This was addressed in a meeting at Utstein Abbey, Norway in 2002 where a unified pathway for reporting was described and has subsequently been updated<sup>[6]</sup>. This has enabled considerable research into systems and interventions attempting to improve resuscitation following cardiac arrest. The same format has now been applied for documentation of EMS dispatch<sup>[7]</sup> and major trauma data<sup>[8]</sup> with the specific objective of enabling direct comparisons between EMS systems of response times and patient outcomes.

### Studies of direct comparisons

- 8.3 In 2003, a cost-effectiveness study comparing a UK, paramedic based EMS system (West Midlands Ambulance Service, WMAS) and the German, medic led, system (Bonn) was performed<sup>[9]</sup>. This was a comparative data study from which results were extrapolated for the first quarter of 1997. In essence the paper reported that:
- The WMAS used state-of-the-art technology to achieve a reliable and highly efficient service for:
    - Unit Hour Utilisation\* (0.6 vs. 0.33)
    - Response time reliability
- \*Unit Hour Utilisation = Number of transports per period of time/Number of unit hours for same time period
- However, the Bonn medic-led service resulted in improved clinical outcomes and survival to hospital discharge following cardio-pulmonary resuscitation (CPR):
    - 4% vs. 14.7%

## A comparative review of international Ambulance Service best practice

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- Total costs were significantly lower for the WMAS (42% less than Bonn) but for severely ill patients survival for one patient after CPR was almost 4 times more expensive for WMAS.
- 8.4 One of the main factors thought to be responsible for such improvements in outcomes was the use of pharmacological treatments in the pre-hospital setting, which was considerably lower in the WMAS (12.9% vs. 32.4%). This study was assessing systems over 16 years ago and developments in treatment protocols and training for UK based paramedics has increased the utilisation of drugs in the pre-hospital setting.
- 8.5 These findings are unlikely to be reflective of the current situation within the UK. However, a single study in London assessing the feasibility of a physician response unit (similar to that in mainland Europe, enabling more use of pharmacological treatments) in order to reduce ambulance patient transports to local emergency departments, demonstrated a significant reduction thus releasing a significant number of ambulance units from ‘unnecessary’ transports<sup>[10]</sup>.
- 8.6 A descriptive paper from 1999 compared resuscitation in five European EMS systems<sup>[11]</sup> and reported seemingly high survival to hospital discharge rates from all regions (Bonn, Gottingen, Helsinki, Reykjavik, Stavanger). However, there was no formalised data collection or reporting mechanisms employed and sample sizes were small for some regions. Perhaps the most relevant point from this report was that all regions were seeking to expand public involvement in the resuscitation process either through:
- Telephone guided CPR
  - Public education programmes in Basic Life Support (BLS) and Automatic External Defibrillator (AED) usage
  - Public education to reduce delay in reporting symptoms
- 8.7 An observational study comparing pre-hospital trauma care systems was published in 2007<sup>[12]</sup> using the local trauma data registries. The primary objective was to compare paramedic (or ALS) systems with medic-led (or Doc-ALS) systems and only looked at developed countries with advanced pre-hospital trauma care systems. Two primary outcomes were identified as reflective of pre-hospital care:
- Emergency department shock (systolic blood pressure <90 mmHg)
  - Early fatality rate (death within 24 hours of hospital arrival)

## A comparative review of international Ambulance Service best practice

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- 8.8 The results suggested a slight improvement in early fatality rates in the Doc-ALS systems (OR: 0.70, 95% CI: 0.54-0.91), but a number of reservations are made within the text concerning missing data, potential differences in reported data and marked heterogeneity between regions with the same EMS system. The authors make a final call for prospective multicentre studies with similar data collection protocols and uniform inclusion criteria as the best approach to establishing good evidence.
- 8.9 The same group of authors used local trauma data registries again to compare developing and developed countries with regard to patient and injury related characteristics as well as the care system itself<sup>[13]</sup>. In conclusion, a call for a minimum standard data set for all trauma patients is made, with a view to facilitate future international research projects.
- 8.10 A direct comparison of the Victorian (Australia) and Hong Kong trauma care systems<sup>[14]</sup> looked at patient level data with a multivariate regression analysis to identify factors that influence patient outcomes between systems. This was the only study of this type identified and the conclusions demonstrated that international comparison is possible with potential areas for improvement being identified – in this case:
- Increased utilisation of intensive care units
  - Increased activation of trauma teams from the pre-hospital setting
- 8.11 One important point made is that the ‘worse’ performing system (Hong Kong) was actually comparable to previously described international standards.
- 8.12 Only three other direct comparisons of systems were identified but date from the early 1990’s and as such represent outdated information<sup>[15, 16, 17]</sup>. This is following the development of pre-hospital care, in particular within the UK and the establishment of extensive treatment guidelines for paramedics by the Joint Royal Colleges Ambulance Liaison Committee (JRCALC) – the latest of which were published in 2006<sup>[18]</sup>.

### Indirect

- 8.13 Different EMS systems are extensively described in a number of articles. European based reports, such as the Hesculaep project and the EED project<sup>[3,4]</sup>, have been established to start to standardise data collection for future collaborative research and comparisons between systems, although patient outcomes do not specifically feature in the current plans.
- 8.14 A series of articles in the journal ‘Resuscitation’ from 2003/04 offer a description of the different EMS systems from around the world but make no attempt to compare them directly. These articles provide useful basic information about the different systems in use with some historical information on how such systems have developed. All appear to be struggling with an increasing demand for services and balancing cost and clinical effectiveness but until a unified data collection system is established direct system comparison remains elusive.



## A comparative review of international Ambulance Service best practice

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8.15 Using the CAEMS report from 2005<sup>[5]</sup> it is possible to draw some indirect comparisons between systems. This report includes a number of nationwide benchmarks for US high performance EMS and attempts to combine system information across Europe and Canada for comparison. The reported data appears to highlight the difficulty in amalgamating information from across heterogeneous systems (such as Europe) but some interesting data are evident and summarised in Table 1 below.

**Table 1 – Example of international comparisons between EMS systems**

Region	Return of spontaneous circulation Utstein Definition following cardiac arrest	Unit Hour Utilisation
• US systems	• 21%	• 0.31
• Canada	• 20%	• 0.19
• Europe	• 15%	• 0.22
• (Richmond, VA)	• 25%	• 0.37
• (WMAS, UK)	-	• 0.60*/0.40 <sup>#</sup>
• (Bonn, Germany)	-	• 0.33*

\* Secondary data from Fischer et al 2003

# From CAEMS report

8.16 The latter data are for individual systems and demonstrate how such systems can be compared to established benchmarks.

8.17 Benchmarking of EMS systems is discussed in the performance indicators section.

## 9. RESPONSE TIMES

- 9.1 Emergency Medical Services have been working to achieve response time targets across the globe, based on data from studies in the 1980's and 90's. The most generally recognised of these is the ability to reach a cardiac arrest patient within 8 minutes of receiving the call. This was based on evidence from Eisenberg and ACLS guidelines from the European Resuscitation Council<sup>[19, 20, 21]</sup>.
- 9.2 More recent work in Canada has suggested that a faster response time and defibrillation would improve survival from out-of-hospital cardiac arrest significantly and argues that the target should be less than 8 minutes<sup>[22]</sup>. At the time the Canadian EMS service would aim to reach over 90% of cardiac arrests within the 8-minute target. The OPALS study identified that reducing the 90th centile response time to 5 minutes (90% or more patients reached within 5 minutes) would result in an increased survival rate of 12% (which reflected 86 lives saved) when compared to the 8-minute target. Importantly the survival outcome was to hospital discharge (as recommended by the American Heart Association and the Utstein template and soon to be the outcome measure for US ambulance services) and not ROSC at hospital arrival, as currently used in most of the UK.
- 9.3 Direct comparison of response time standards was performed for the EED project (1997-2002)<sup>[3]</sup> and included in the CAEMS report of 200.<sup>[5]</sup> as shown in Tables 2 and 3 and Figure 1 below.

**Table 2 – EED project (Life-threatening emergency response time standards)**

System	Time (mins/secs)	Compliance standard
Copenhagen, Denmark	04:45	No data
Genoa, Italy	08:00	No data
Bonn, Germany	07:59	90%
Richmond, USA	08:59	90%
Ulleval, Norway	09:39	No data
West Midlands, UK	08:00	75%

# A comparative review of international Ambulance Service best practice

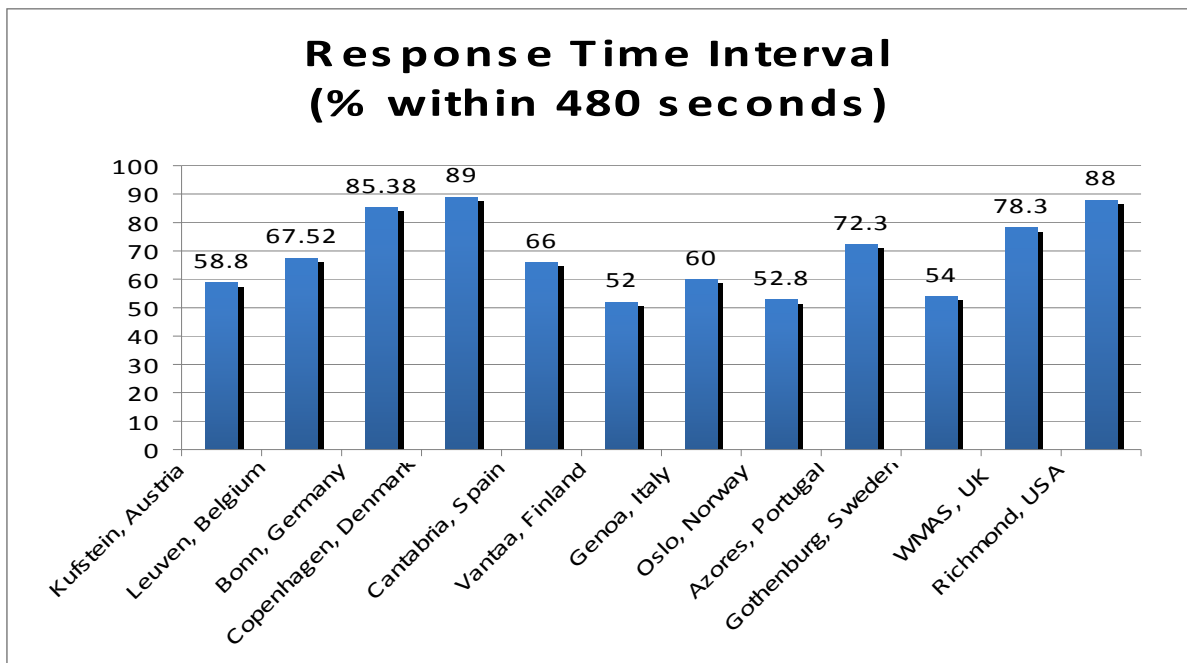
**Table 3 – Identified Response time standards by country**

Country	Category A	Category B	Category C	Compliance %
UK	8:00	19:00	60:00Variable*	75/95/95
US	8:59-15:00*		Variable*	90
US @	8:00			90
Australia	15:00	25:00	60:00	90/90/90
Canada	8:59			90

\*Specified by local county/state regulations/agreements [CAEMS] – commonly 60 minutes in UK

@ National Fire Protection Association 1710 standard - (BLS/first responder within 4 minutes and ALS unit within 8 minutes)

**Figure 1 – Data from the EED project (1997-2002)**



9.4 Locally agreed US targets vary for urban, rural and wilderness geographical settings:

Urban	08:59	90% compliance
Rural	15:00	90% compliance
Wilderness	30:00	90% compliance

## A comparative review of international Ambulance Service best practice

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- 9.5 Recommendations have been made that time to first response and commencement of cardiopulmonary resuscitation (CPR) by a basic life support (BLS) provider should be less than four minutes with advanced life support (ALS) arrival within 8 minutes, which would improve survival rates for all out of hospital cardiac arrests<sup>[23]</sup>. These considerations are accounted for in the latest performance indicators for both the US and UK services and included later in this report. They are the current 1710 standard for the NFPA in the US.
- 9.6 There has been much focus on response times and the local targets that have been set, with debate on when the time measured should start and end and accurate systems of measuring such 'to-the-second' responses. Concerns have been raised that the vertical response time for high-rise apartments and office buildings is not appropriately accounted for<sup>[24,25]</sup> as well as vehicle-at-scene to patient access (VSPA) interval not being included in standard response time measurements<sup>[26]</sup>.
- 9.7 Release of ambulance service/EMS staff following handover at emergency departments has also been an area of focus internationally. Delays at the ED, often because of overcrowding, mean that EMS staff are unavailable to attend to the next emergency call, effectively diminishing the available coverage for an area and subsequently increasing response time intervals<sup>[27]</sup>. In North America (US and Canada) this has reached concerning proportions<sup>[28]</sup>.
- with an average of one in eight ED attendances affected
  - rising to one in six over the winter months (January-March)
- 9.8 Such that the US Metropolitan Municipalities' EMS medical Directors Consortium produced a paper listing suggestions for improvement in 2005<sup>[29]</sup>. Discrepancies between actual 'turnaround interval' and that reported by radio have been identified and reliance on radio reporting may be flawed when attempting to improve these turnaround times<sup>[30]</sup>.
- 9.9 This has led to the agreement that, whilst the response times offer a measurable benchmark for the service provided, it should not be the only marker and clinical outcomes are now taking a more prominent role in service assessment with the introduction of clinical performance indicators, discussed later in this report.
- 9.10 Studies, using alternative emergency services, have been performed with some evidence that police and fire crews with BLS and defibrillation skills (using automatic external defibrillators (AED)) do appear to improve both response times and more importantly, survival to hospital discharge<sup>[31,32]</sup>. The placement of AEDs in shopping centres, public transport hubs and sports grounds is commonplace with the same success in reducing time to defibrillation and BLS<sup>[33]</sup>. Alternatively, community first responders can be dispatched to such cases but the process is hampered by the moderate sensitivity of the AMPDS system in identifying cardiac arrest. However the idea of community first responders being dispatched to such cases - rather than static AED placement - by the currently used AMPDS system is slightly flawed by the moderate sensitivity of the system to accurately identify cardiac arrest<sup>[34]</sup>.
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## A comparative review of international Ambulance Service best practice

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- 9.11 Importantly, with the imposition of strict response time targets, technology has developed that enable the dispatch centre and working crews to communicate more rapidly and for large geographical areas to be optimally covered by the emergency services. Geographical information systems<sup>[35]</sup>, the use of Global positioning system (GPS) navigators<sup>[36]</sup>, demand pattern analysis programs<sup>[37]</sup> and mobile phone locating systems (in the urban setting)<sup>[38]</sup> have all been shown to positively influence the response times of first responders and ambulance units.
- 9.12 No literature was identified that specified pre-hospital targets for trauma cases although one article had attempted to provide a framework for future benchmarking by performing a meta-analysis of previously reported findings<sup>[39]</sup>.

## 10. PERFORMANCE INDICATORS

- 10.1 In 2006 the Joint Royal Colleges Ambulance Liaison Committee (JRCALC)<sup>[18][17]</sup> established a comprehensive list of clinical guidelines for ambulance trusts based on current evidence and expected quality of practice. Some of these guidelines have been expanded to performance indicators for the ambulance services within the UK with the focus on six potentially life-threatening conditions. These have been compiled by the Care Quality Commission and are in addition to the current response time targets for category A and B calls<sup>[40,41]</sup>.
- 10.2 These indicators were specified in the latest document from the Care Quality Commission and are predominantly based on recommendations from the JRCALC 2006 with contributions from National Institute for Clinical Excellence, and the National Service Framework for Coronary Heart Disease (Table 4) and the National Cardiac Ambulance audit scoping paper.
- 10.3 No direct comparisons with international practice, of these performance indicators, were identified in the literature.
- 10.4 A similar set of clinical performance indicators were described in 2007 by the Consortium of Metropolitan Municipalities EMS directors. These include similar areas of life-threatening conditions and go on to estimate the Number Needed to Treat (NNT) for each intervention described from the literature<sup>[42]</sup>.
- 10.5 There is understandably some overlap with the UK targets as the evidence from which such targets are set applies internationally. The key differences are reported below in Table 5.
- 10.6 Further treatment protocols and guidelines for the EMS in Canada, South Africa and regions of the US were identified but these had not been translated into performance indicators for such services. This is in keeping with the UK system where treatment guidelines exist from JRCALC but only particular aspects of these guidelines are used for comparison.
- 10.7 A recent publication assessing the role of physician medical direction and clinical performance in established EMS systems demonstrated considerable improvement in working practice of the paramedic and EMT staff, advocating the concept of a medical led service<sup>[43]</sup>. This is current practice in the UK although the amount of direct medical control of paramedic practice varies between the UK and US systems with the US medical control being much more hands-on, direct case management and the UK being more of a governance and protocol derivation role.

**Table 4 – 2008/09 Performance Indicators for UK ambulance trusts**

<p><b>Stroke/TIA</b></p> <p>The anticipated outcome is improved assessment and subsequent management of stroke patients.</p> <p>Indicators</p> <ol style="list-style-type: none"> <li>1. Recording of Face Arm Speech Test (F.A.S.T.)</li> <li>2. Recording of blood glucose level</li> <li>3. Recording of blood pressure</li> </ol> <p>Pilot indicators also being investigated are:</p> <ol style="list-style-type: none"> <li>a) Recording of the time of onset of stroke</li> <li>b) The care bundle of indicators 1+2+3</li> </ol>	<p><b>STEMI (ST elevation myocardial infarction)</b></p> <p>The anticipated outcome is improved assessment and management of STEMI with overall improved survival.</p> <p>Indicators</p> <ol style="list-style-type: none"> <li>1. Administered Aspirin</li> <li>2. Administered GTN</li> <li>3. Recording of pain scores (before and after treatment)</li> <li>4. Administration of analgesia (morphine and/or Entonox)</li> <li>5. Transfer targets for thrombolysis/PCI<sup>[MINAP]</sup></li> </ol> <p>Pilot indicators include:</p> <ol style="list-style-type: none"> <li>a) Recording of SpO<sub>2</sub></li> <li>b) Care bundle of indicators 1-4</li> </ol>	<p><b>Cardiac Arrest</b></p> <p>Anticipated outcomes are improved response to and survival from cardiac arrest through rapid return of spontaneous circulation (ROSC).</p> <p>Indicators</p> <ol style="list-style-type: none"> <li>1. ROSC at arrival at hospital</li> <li>2. Presence of defibrillator on scene</li> <li>3. ALS provider in attendance</li> <li>4. Call to scene response ≤4 minutes</li> </ol> <p>Pilot indicator:</p> <ol style="list-style-type: none"> <li>a) Care bundle of 3+4</li> </ol>
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Table 4 – 2008/09 Performance Indicators for UK ambulance trusts (cont)

<b>Hypoglycaemia:</b>	<b>Asthma:</b>	<b>Trauma:</b>
<p>Anticipated outcomes are improved assessment and management of hypoglycaemic patients</p> <p>Indicators</p> <ol style="list-style-type: none"> <li>1. Recording of blood glucose before treatment</li> <li>2. Recording of blood glucose after treatment</li> <li>3. Treatment for hypoglycaemia recorded</li> <li>4. Direct referral to appropriate health professional</li> </ol> <p>Pilot indicator:</p> <p>a) Care bundle of 1-3</p>	<p>Outcomes to improve assessment and management of asthma</p> <p>Indicators</p> <ol style="list-style-type: none"> <li>1. Recording of respiratory rate</li> <li>2. Recording of Peak Expiratory Flow Rate (PEFR)</li> <li>3. Recording of SpO2</li> <li>4. Administration of <math>\beta</math>2-agonist</li> <li>5. Administration of Oxygen</li> </ol> <p>Pilot indicator:</p> <p>a) Care bundle of 1-3</p>	<p>Pilot Indicators only in patients with Glasgow Coma Score (GCS) &lt;8 with severe trauma:</p> <p>a) Recording of blood pressure</p> <p>b) Recording of respiratory rate</p> <p>c) Recording of SpO2</p> <p>d) Recording of pupil reaction</p>



**Table 5 – US clinical performance indicators**

<p><b>STEMI:</b></p> <p>Alternate indicators: 1. ECG interpretation or transmission to designated emergency physician 2. Pre-arrival activation of interventional cardiology team at designated PCI facility 3. Elapsed time from acquisition of diagnostic ECG to balloon inflation of less than 90 minutes</p>	<p><b>Cardiac Arrest:</b></p> <p>Alternate indicators: 1. Defibrillator (AED) to scene &amp; basic CPR in &lt;5 minutes</p>	<p><b>Respiratory Distress:</b></p> <p>Presumed due to flash pulmonary oedema / Congestive Heart Failure</p>	<p><b>Asthma (bronchospasm):</b></p> <p>The only indicator described is the administration of <math>\beta_2</math>-agonist, however no statistical analysis has been identified to demonstrate a quantifiable benefit.</p>	<p><b>Status Epilepticus:</b></p> <p>For patients with seizure activity lasting longer than 15 minutes or 2 or more seizures without an intervening period of clear mental status.</p>	<p><b>Trauma:</b></p> <p>In the US the establishment of trauma centres has influenced the nationwide management of trauma patients significantly. Evidence based on trauma registry data and pre-hospital advanced life support studies has led to the following indicators:</p>
		<p><b>Indicators:</b></p> <ol style="list-style-type: none"> <li>1. Administration of GTN</li> <li>2. Pre-hospital Non-invasive Positive Pressure Ventilation (NIPPV)</li> </ol>		<ol style="list-style-type: none"> <li>1. Recording of blood glucose</li> <li>2. Administration of benzodiazepine by the best available route (IM, IV, rectal, nasal)</li> </ol>	<ol style="list-style-type: none"> <li>1. Limitation of safe, non-entrapped scene time to &lt;10 minutes</li> <li>2. Direct transport to dedicated trauma centre</li> <li>3. Transport time with air ambulance (including ground and transport time intervals) should not exceed the time taken for direct ground transport to trauma centre.</li> </ol>

Table 5 – US clinical performance indicators (cont)

STEMI:	Cardiac Arrest:	Respiratory Distress:	Asthma (bronchospasm):	Status Epilepticus:	Trauma:
<p>Comparative indicator: a. Administration of Aspirin</p> <p>The delivery of such an overall care package was estimated to result in an absolute reduction of 6% in the composite endpoint of diminishing stroke, second non-fatal MI or death – resulting in a NNT of 15 to avoid these complications in one patient<sup>[44,45]</sup>.</p>	<p>Based on a single paper from 2003 this was thought reduce death by as much as 12% - so a NNT of 8 patients for one survivor<sup>[22]</sup>.</p>	<p>The outcome of these as a complete care package was estimated to reduce the number of intubations required by 16-20% - giving a NNT of 6 for every intubation avoided. As an addendum to this, the authors comment that short transport times (10-15 minutes) may limit the absolute value of NIPPV and as such it should not be mandatory<sup>[46]</sup>.</p>		<p>This administration will terminate 42-59% of episodes (when compared with 21% with placebo) giving an estimated NNT of 4 for every seizure that is terminated<sup>[47]</sup>.</p>	

## A comparative review of international Ambulance Service best practice

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10.8 Comments from the authors of the report concluded that other surrogate markers were discussed but based on retrospective Injury Severity Score (ISS) data that is not obtainable in the pre-hospital setting. These surrogate markers of retrospectively collected data would suggest that for all patients with an ISS>15 delivered direct to the trauma centre, the number needed to treat (NNT) to save one life is 11, whilst this reduces to 3 if the patients are over 65 years and ISS>21.

10.9 Such clinical indicators were not identified from other international EMS services although both Canada and Australasia are developing such national strategies. Extensions to the clinical performance indicators for category B patients within the UK are also in development at the time of this report.

10.10 Australia use eight performance indicators for assessment of their state run services<sup>[48]</sup>, some of which overlap with the benchmarking indicators from the EED project (Table 7):

- Survival rate from out-of-hospital cardiac arrest
- Ambulance incidents responses and patients per 100,000 people
- Proportion of emergency cases which receive a paramedic level of response
- 50th and 90th percentile response times
- Level of patient satisfaction
- Unit cost
- Expenditure per urgent and non-urgent response
- Expenditure per person

10.11 Aspects that these Australian services are looking to expand upon as a national framework are:

- Triple zero answering time
- Appropriateness (meeting clients' needs)
- Clinical incidents
- Clinical indicators of interventions and treatments
- Continuity of care (extension of appropriateness)
- Sustainable workforce
  - Assessment of current workforce by age
  - Staff attrition rates
- Pain management
- Cardiac arrest survival and to hospital discharge

## 11. BENCHMARKING

11.1 It is now widely recognised that sole reliance on response times to compare emergency medical service performance is restrictive and poorly reflective of a majority of ambulance service work. However, the concept of quantifying aspects of such work is important with regard to improvement of services. This can be best achieved by comparing current practice with other similar systems around the world and a series of benchmarks are required with which to do this. Concerns have been raised about universally comparing all emergency systems and it has been suggested that four broad categories of system would permit more accurate comparison <sup>[49, EMJ 2003, MacFarlane]</sup>. These would be:

- Services with comparatively short pre-hospital time and sophisticated receiving institution e.g. western urban centre's
- Services with comparatively long pre-hospital times and sophisticated receiving institution e.g. western rural centres
- Services with comparatively short pre-hospital times but to a small unsophisticated receiving centre e.g. rural areas
- Services with comparatively long pre-hospital times and delivery to a small unsophisticated centre

11.2 The focus of this report is on systems comparative to the UK which broadly align with the first point above. Two main projects were identified that aimed to establish benchmarks for EMS systems across a variety of geographical and financial settings. In Europe a set of benchmarks were described from the European Emergency Data (EED) project, which were considered to give a generalised and overall perspective of each individual country's service that would enable stakeholders to make future comparisons between systems. These were established by consensus opinion from a list of over 100 potential indicators (see Table 6).

Evidence for clinical performance indicators: (Table 7)

11.3 The Joint Royal Colleges Ambulance Liaison Committee (JRCALC) in 2006 developed an extensive list of clinical guidelines for ambulance trusts from which to base their clinical service delivery. The guidelines have evolved from locally derived guidance (mainly developed using non-systematic approaches) to systematically developed national clinical practice guidelines developed to universally agreed standards based on current best evidence. They are an important part of clinical risk management and ensure uniformity in the delivery of high quality patient care. As such they form the basis for UK paramedic training and education and are internationally renowned. The guidelines are reviewed on a five-year cycle and are developed or updated, based on systematic reviews of the evidence and consensus agreement.

- 11.4 The Myocardial Infarction National Audit Project (MINAP) is a national data collection mechanism for all patients who suffer myocardial infarction. Included in the data collected are the figures for the proportion of ambulance thrombolysis performed as well as the proportion of patients receiving thrombolysis within 60 minutes of a call for help. Data are also collected on the number of patients transferred directly for primary percutaneous coronary intervention (PCI).

**Table 6 – EED Benchmarking indicators**

1	<b>Unit hours of ELS+BLS+ALS per 100,000 inhabitants</b>	a) 3 sub-indicators for ELS, BLS and ALS	b) Seen as an indicator for health system resources
2	<b>Response Time</b>	a) 2 sub-indicators i. 90% percentile ii. Percentage <480secs	b) Seen as an indicator of health system performance
3	<b>Rate of highest priority responses per 100,000 inhabitants</b>		a) Seen as an indicator of health system utilisation (demand)
4	<b>Rate of First Hour Quintet (FHQ) diagnoses per 100,000 inhabitants</b>	a) 5 sub-indicators i. Cardiac arrest incidents ii. Severe trauma incidents iii. Severe breathing difficulties iv. Cardiac chest pain incidents v. Stroke incidents	b) An indicator for health status (morbidity/mortality)
5	<b>Rate of ALS interventions per 100,000 inhabitants</b>	a) 3 sub-indicators i. Assisted ventilation ii. Intubation iii. IV drug administration	b) An indicator of health system performance

# A comparative review of international Ambulance Service best practice

**Table 7 – Samples of evidence for clinical performance indicators**

Study	Year	Design	Intervention	Limitations	Outcome	Results
Hubble et al	2006	Prospective case-control study of respiratory distress thought to be acute pulmonary oedema (APE)	Current APERx (95 pts) vs. Current APERx + CPAP (120)	Small numbers Non-randomized Short-term mortality data only	1' - endotracheal 2' - mortality, hospital LOS, physiology change	ETI - increased in controls (OR=4) Mortality increased in controls (OR 7.5)
Fergusson et al	1995	Prospective cohort study	Administration 5mg salbutamol nebuliser to asthma patient <40 yrs	No comparative group Small numbers	Increase in post nebuliser PEFR	80% of patients demonstrated significant rise in PEFR
Richmond et al	2005	Prospective cohort study	Administration of albuterol nebuliser by BLS EMS crews	No comparative group	Increase in post nebuliser PEFR (as a proportion of predicted) Borg Dyspnoea Index	Increase from 40% TO 54.5% of predicted PEFR Improved index score
Ronning et al	1999	Quasi-randomized control trial	O2 for 24 hours following acute CVA vs. no O2	Randomization method explored Confounding factors	1 year survival, neurological impairment, disability	Improved survival in severe stroke in control group (OR=0.45)
Lerner et al	2003	Prospective cohort study	IV dextrose for hypoglycaemia and discharge (with advice) 36 patients	Low numbers Adverse outcome	1' - post discharge complications 2' - satisfaction rating	1/36 poor outcome 91% satisfaction rating
Harbison et al	2003	Comparative study of referrals to acute stroke unit using FAST tool for ambulance staff	Ambulance (178) vs. primary care (216) vs. ED doctors (93) referrals		Proportion of stroke vs non-stroke patients Proportion admitted under 3 hours to ASU (so thrombolysis possible)	Correct diagnostic: Ambulance 77% Primary care 71% ED Docs 71% Admitted <3 hours 48% vs 16% vs 11%
Widimsky et al	2003	Randomized mortality trial in STEMI <12 hrs presenting to a community hospital PRAGUE-2	Transport for primary PCI vs. in-hospital thrombolysis		1' - 30/7 mortality 2' - death, reinfarction or stroke at 30/7	<3 hrs - no mortality difference 7.3% vs. 7.4% >3 hrs - 6% vs. 15.3% mortality so transfer for PCI better if >3 hours post AMI
Allredge et al	2001	Randomized double-blind trial of benzodiazepines vs. placebo for out-of-hospital seizure	Lorazepam (66) vs. diazepam (68) vs. placebo (71) in patients with prolonged or repeated seizures	Low numbers	1' - seizure termination 2' - respiratory / cardiac complications	1' - (OR)lorazepam vs. placebo = 4.8) 2' - similar complication rates

## 12. DEMAND

12.1 The issues surrounding demand for services were searched using Medline, Medline in Process and the Science and Social Science Citation Index. There were 318 references on Medline, 10 on Medline in Process and 189 on the Citation Indexes, using the following search strategy:

Database: Ovid MEDLINE(R) <1950 to June Week 2 2009>. The Search Strategy is further detailed in Appendix 2.

12.2 The issue of increasing demand for emergency medical services has attracted comment in the literature for many years<sup>[55]</sup>. Recent UK ambulance service statistics confirm the continued trend of an increase in emergency and urgent call numbers (7.23 million for 2007/08<sup>[56]</sup>). This, however, does not directly match the total number of patient journeys, which has shown a steady decline from 2003/04 (17.81 million to 13.77 million) and this decline may be due to some of the management strategies that have been developed with in the UK over the last five years.

12.3 Within this report we were charged with focusing on two areas of demand for emergency services. These were firstly the processes of assessment within current EMS systems in order to understand and potentially predict service demand, and secondly the enabling of a degree of management of such demand. This was exclusive of major incidents or events for which separate planning and execution strategies already exist.

12.4 Within the United Kingdom ambulance services there already exist data collection methods to analyse a number of different areas. Previously in this report we have covered the issues of response times and performance indicators for ambulance trusts in the UK and some international comparators.

12.5 The number and pattern of ambulance call-outs is routinely collected information from which demand pattern analysis is performed and staffing/unit levels are allocated on such predicted patterns<sup>[37]</sup>. This has been demonstrated to have a moderate accuracy with a tendency to overestimate demand most of the time, with the occasional underestimation<sup>[37, Brown PEC 2007]</sup>. These fluctuations in unit and staffing levels are coupled with a geographic information system that enables the local control centre to identify where units are around the region and allocate the next most appropriate response in a timely fashion to the next emergency call. If a sudden demand peak were to occur, the AMPDS would prioritise cases based on clinical need.



## A comparative review of international Ambulance Service best practice

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12.6 Factors that have been linked with higher ambulance utilisation include<sup>[57-59]</sup>:

- Mental health problems (suicide/overdose)
- Older population
- Night attendances to ED
- Payment for ambulance service
- Injury related visits
- Urgent visits and requiring admission

12.7 Nearly all of these data are collected routinely within the ambulance service already.

12.8 Very few studies targeted specifically at reducing demand for emergency medical services were identified. There exist a number of epidemiological studies into the use of the ambulance service and, owing to often poor methodology, a wide range of estimates have been reported (from 11 to 51%) for inappropriate use by patients, often based on retrospective 'expert clinical' opinion<sup>[60]</sup>.

12.9 With specific regard to managing demand the focus has been on reducing transports by providing care in the community. This has been investigated as:

- Telephone advice for non-urgent calls
- Paramedic/Emergency care practitioners

12.10 Both of these techniques appear to safely reduce the number of emergency department attendances and modelling based studies have demonstrated the maximal benefit for hospital services (specifically hospital bed occupancy and elective admission rates) by keeping people out of hospital<sup>[61,62]</sup>.

12.11 The use of telephone triage systems for non-urgent calls does appear to be able to safely transfer most patients for nurse directed advice about their healthcare problems and provide an acceptable and cost-effective method for avoiding ambulance callouts<sup>[63, SDO report 2007]</sup>. However, concerns have repeatedly been raised about the software used and the rate of under triage for more serious illnesses<sup>[64,65]</sup>, and this practice is only applicable to a small proportion of the total number of 999 calls received, in the region of 10%<sup>[Giesen QSHC 2007, O'Caithain EMJ 2003]</sup>. It has been established that paramedics were not sufficiently able to determine which patients would be suitable to remain at home following assessment<sup>[66-68, Clesham EMJ 2008, Hauswald PEC 2002]</sup> and the extended role of emergency care practitioner (ECP) has evolved from this.

## A comparative review of international Ambulance Service best practice

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- 12.12 The development of emergency care practitioners to work in the community and provide direct patient care at the scene has been evolving in the UK over the past five years<sup>[69, Bradley DH]</sup>. Studies have repeatedly noted a reduction in the number of ambulance transports to the ED and that implementation estimates prove cost-effective for the PCTs who commission such services<sup>[70,71, Gray 2008 EMJ, Mason 2007 EMJ, DH report filed 2006]</sup> and a full national evaluation of the effectiveness of these practitioners is currently in press with the National Institute for Health Research: SDO programme<sup>[72, NEECaP]</sup>.
- 12.13 A further study in Norfolk put together a multi-disciplinary team to assess those patients with immediate care needs, based on the initial phone call to GP reception/ambulance control. The first eight months of utilisation of the 'appropriate care at point of need' (ACAPON) system established a reduction in ambulance transports to the local emergency department and demonstrated a considerable cost saving to the practice involved<sup>[73]</sup>.
- 12.14 The team consisted of an on-call GP, practice nurse, health-care assistant and a community paramedic, with the patient calls being triaged by the GP. Secondary effects also included an improvement in response times for category A calls from 55% to 85%. The question of whether the benefits of this study were down to the medic triage or the paramedic practitioner's role, have not been answered.
- 12.15 Generally, these studies look at developing an alternate pathway for patients to the usual ambulance transports to the ED and have not specifically focused on the time resources necessary with one study reporting that individual cases were taking up to two hours to resolve<sup>[74, Dixon EMJ 2009]</sup>. This same study noted that secondary hospital service utilisation following ECP intervention was increased compared with the control group of current practice, a finding not shared in the evaluation report submitted to the Department of Health in 2005<sup>[75]</sup>.
- 12.16 Overall, although ECPs have been demonstrated to successfully manage the demand on ambulance transports in a cost-effective manner, they do not manage the overall use of ambulance service resources (still requiring prolonged staff time) or reduce the demand for emergency care.
- 12.17 Public education may also have a role to play in reducing demand. Although no literature that prospectively assessed such campaigns was found, a retrospective before and after analysis of ambulance callouts in one city in Japan suggested that a significant reduction of non-serious (category C) and serious but non-life-threatening (category B) call-outs was achieved following the introduction of one such intervention<sup>[76]</sup>. A similar preventative theme was found in a review article from 1993<sup>[77]</sup>, which highlighted a series of papers that demonstrated a reduction in healthcare expenses when company fitness regimes and health promotion activities were introduced. The studies included were not specific to emergency service use, however, and direct translation to such services is not possible.

## A comparative review of international Ambulance Service best practice

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12.18 One study focusing on empowerment of the public to self-care did reduce the number of total illness and minor illness presentations to ambulatory care, which could have an effect on category 'C' callouts, or ED visits in the UK although no prospective work was identified<sup>[78]</sup>.

### 13. SUMMARY

- 13.1 Ambulance service trusts within the UK are considered amongst the high-performing emergency medical services from around the world. Very little research was identified from which to directly compare services across the international stage but consortiums of service leaders are working towards generally applicable benchmarks through which different pre-hospital services can be compared.
- 13.2 Two main systems of pre-hospital care were identified:
- Paramedic led (with medical governance)
    - Highly efficient using advanced technologies
    - Rapidly improving patient care pathways
    - Introduction of clinical performance indicators
  - Physician led
    - Complex systems of triage
    - Delivering care direct to the patient
    - Fewer, more appropriate ambulance transports to hospital services
- 13.3 Neither obviously outperformed the other, mostly due to years of system optimisation, and elements of each are being considered to adapt the others system to accommodate changing priorities and needs.
- 13.4 The problems of increasing demand for services, both pre-hospital and emergency department care, are universal and very few strategies have been robustly tested to combat such increases. Repeatedly the literature calls for more quality research in to the issues identified, in order to quantify and qualify the problems faced, and then adapt them in a reproducible and measurable way such that service improvements can be easily demonstrated. Research across agencies has been identified as an area for development with the Hesculaep project in Europe.
- 13.5 Communication between agencies in order to develop national strategies for the heterogeneous regional services currently in existence are being encouraged both in North America and Australasia and the European Emergency Data project is aiming to do the same in Europe.
- 13.6 There were no obvious lessons to be learnt from international EMS practice that would have the potential to greatly improve the current state of UK ambulance services. Small studies introducing the physician-led European style of pre-hospital care do appear to positively influence patient outcomes both with previous response time targets (by freeing up other ambulance crews) and reducing the number of 'unnecessary' patient journeys. Paramedic and community practitioners are already expanding their role along these lines but still operating under protocol and appear to be able to provide a viable alternative to transfer of patients to hospital.

## A comparative review of international Ambulance Service best practice

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- 13.7 The primary concern, that of winter pressures resulting in a relative drop in performance has been identified in other systems, with less stringent targets, and no solutions were established. At present the inability to directly compare pre-hospital healthcare systems makes it impossible to identify system factors that would obviously improve performance, quality of care or efficiency and effectiveness (although many were postulated).

#### 14. RECOMMENDATIONS

- 14) Promote and continue involvement in international research projects aimed at benchmarking important service indicators to ensure that UK ambulance services remain at the forefront of pre-hospital care.
- 15) Continue to research and develop how elements of each of physician and paramedic led services can be adapted to accommodate changing priorities and needs and improve quality of care and value for money.
- 16) Promote international collaboration of EMS Medical Directors to identify strategies that may combat the rising demand for emergency care and improve the quality of service and care for patients.
- 17) Continue political and financial support to the evolution of the current ECP and advanced practitioner programs and expansion nationwide.
- 18) Establish a national review of computer aided dispatch software to optimise sensitivity and specificity in medical emergencies.
- 19) Ensure prospective evaluation of public health campaigns in self-empowerment and their impact in reducing ambulance use.
- 20) Develop national and local research programmes to identify the root cause of increasing demand for services and potential strategies to alleviate pressures on both ambulance trusts and emergency departments.
- 21) Promote and enhance collaboration at a local level between Primary Care, Ambulance and Hospital trusts to develop an overall programme for emergency care within a region.

**APPENDIX 1 – SUMMARY OF CO-ORDINATED EMS DATA PROJECTS**

Project title	Subtitle & focus	Brief	Outputs	Recommendations
EED Project Published 01/2006	Health Monitoring and benchmarking of European EMS Systems: Components, Indicators, Recommendations	Comprehensive system analysis to provide an essential tool for identifying excellence and best practice in EMS for future recommendations on pan European standards for EMS provision	5 initial key community health indicators: -Unit hours per 100,000 inhabitants -Response time -Rate of highest priority responses per 100,000 -Rate of first-hour quintet (FHQ) diagnoses per 100,000 -Rate of ALS interventions per 100,000	Future recommendations for development of more comparable indicators. Call for focus on prevention and public health for the FHQ conditions (cardiac arrest, severe trauma, severe breathing difficulties, cardiac chest pain, stroke) to combat the predicted increase in demand
Coalition of Advanced Emergency Medical Systems Published 2006	International EMS Benchmarking Study: A comparison of system design and performance	Five areas of focus with core performance indicators for US based systems. 'To establish a framework that allows comparison of different EMS system designs, providing a foundation for out-of- hospital systems research.'	Sections 1 & 2 Comparative assessment of US systems & longitudinal review using indicators -General information -Response-time reliability -Clinical Capabilities -Economic Efficiency -Revenue Section 3 -EED project data assessed using US indicators Section 4 -Group based data analysis for regional study groups	The development of high quality EMS based research to justify its funding and prove its value to the healthcare system in general

**APPENDIX 1 – SUMMARY OF CO-ORDINATED EMS DATA PROJECTS (CONT)**

Project title	Subtitle & focus	Brief	Outputs	Recommendations
Hesculaep Published 2005	Health Emergency National/Regional Programmes: For an improved coordination in Pre- Hospital Setting ARCHITECTURE DESCRIPTION, BENCHMARKING AND PRIORITISATION	To coordinate the National/Regional Research Programmes in the field of the management of medical emergencies, thus overcoming their current fragmentation, and creating sustainable long term cooperation, in order to improve their overall management.	Describes the different architectures of the EMS among HESCULAEP partners, and opens the way to the identification of the National & Regional research programmes implemented in the frame of the EMS.	Summarises that different heterogeneous systems are becoming more homogeneous with lessons learnt from comparative projects. More coordination required to progress regional research programs.



## APPENDIX 2 – SEARCH STRATEGY

- 1) Ambulances/sd, ma, ut, sn, td [Supply & Distribution, Manpower, Utilisation , Statistics & Numerical Data, Trends] (601)
- 2) ambulance\$.tw. (4793)
- 3) emergency mobile unit\$.tw. (8)
- 4) Air Ambulances/(1295)
- 5) \*Emergency Medical Services/ma, sd, sn, ut, td [Manpower, Supply & Distribution, Statistics & Numerical Data, Utilisation , Trends] (2220)
- 6) (prehospital adj3 care).tw. (1187)
- 7) (pre-hospital adj3 care).tw. (330)
- 8) paramedic\$.tw. (4182)
- 9) or/1-8 (12511)
- 10) \*"Health Services Needs and Demand"/(12067)
- 11) (demand or demands).tw. (67518)
- 12) 10 or 11 (77834)
- 13) 9 and 12 (318)

### APPENDIX 3 – REFERENCE LIST

1. Lipp M (Eds): Preclinical Emergency Medicine Systems - International Comparisons. In *Anaesthetist* 1993, 42: 623-629.
2. Bossaert LL (Eds): The Complexity of comparing different EMS systems - A survey of EMS systems in Europe. In *Annals of Emergency Medicine* 1993, 22: 99-102.
3. T Krafft, L Garcia Castrillo Riesgo, M Fischer, F Lippert, J Overton, I Robertson-Steel. European Emergency Data Project: EMS Data-based Health Surveillance System. Edited by EED Project Group. 2006.
4. Hesculaep: Health Emergency National/Regional Programmes: For an improved Coordination in Pre-Hospital Setting . 2006.
5. J Overton, S Dean, D Edwards, D Andresen. The International EMS Benchmarking Study: A Comparison of System Design and Performance. Edited by T Krafft, L Garcia Castrillo Riesgo, M Fischer, F Lippert, I Robertson-Steel. 2006.
6. Jacobs I, Nadkarni V, the ILCOR Task Force on Cardiac Arrest and Cardiopulmonary Resuscitation Outcomes, Bahr J, Berg RA, Billi JE *et al.*: Cardiac Arrest and Cardiopulmonary Resuscitation Outcome Reports: Update and Simplification of the Utstein Templates for Resuscitation Registries: A Statement for Healthcare Professionals From a Task Force of the International Liaison Committee on Resuscitation (American Heart Association, European Resuscitation Council, Australian Resuscitation Council, New Zealand Resuscitation Council, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, Resuscitation Councils of Southern Africa). *Circulation* 2004, 110: 3385-3397.
7. Castron M, Karlsten R, Lippert F, Christensen EF, Bovim E, Kvam AM *et al.*: Recommended guidelines for reporting on emergency medical dispatch when conducting research in emergency medicine: The Utstein style. *Resuscitation* 2008, 79: 193-197.
8. Ringdal K, Coats T, Lefering R, Di Bartolomeo S, Steen P, Roise O *et al.*: The Utstein template for uniform reporting of data following major trauma: A joint revision by SCANTEM, TARN, DGU-TR and RITG. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* 2008, 16: 7.
9. M Fischer, H Krep, D Wierich, U Heister, A Hoeft, S Edwards. Comparison of the emergency medical services systems of birmingham and Bonn: process efficacy and cost effectiveness. *Anesthesiol.Intensivmed.Notfallmed.Schmerzther.* 38, 630-642. 2003.

## A comparative review of international Ambulance Service best practice

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10. Bell A, Lockey D, Coats T, Moore F, Davies G (Eds):Physician Response Unit - A feasibility study of an initiative to enhance the delivery of pre-hospital emergency medical care. In *Resuscitation* 2006, 69: 389-393.
11. J Herlitz, J Bahr, M Fischer, M Kuisma, K Lexow, G Thorgeirsson. Resuscitation in Europe: a tale of five European regions. *Resuscitation* 41, 121-131. 1999.
12. B S Roudsari, A B Nathens, P Cameron, I Civil, R L Gruen, T D Koepsell *et al.*. International comparison of prehospital trauma care systems. Edited by R L Lefering, M Liberman, C N Mock, HJ Oestern, T A Schildhauer, C Waydhas *et al.* *Injury* 38, 993-1000. 2007.
13. B S Roudsari, A B Nathens, C Arreola-Risa, P Cameron, I Civil, G Grigoriou *et al.*. Emergency Medical Service (EMS) systems in developed and developing countries. Edited by F E Lecky, R L Lefering, M Liberman, C N Mock, HJ Oestern, E Petridou *et al.* *Injury* , 1001-1013. 2007.
14. C H Cheng, C A Graham, B J Gabbe, J H H Yeung, T Kossmann, R T Judson *et al.*. Trauma Care Systems. A Comparison of Trauma Care in Victoria, Australia and Hong Kong, China. *Ann Surg* 247, 335-342. 2008.
15. U Schmidt, S B Frame, M L Nerlich, D W Rowe, B L Enderson, K I Naull *et al.*. On scene helicopter transport of patients with multiple injuries: Comparison of a German and an American System. *J Trauma* 33, 548-555. 1992.
16. A Lechleuthner, C Emermann, A Dauber, B Boullion, J A Kubincanek. Evolution of rescue systems: A comparison between Cologne and Cleveland. *Prehosp Disast Med* 9[3], 193-197. 2009.
17. Eisenberg MS, Horwood BT, Cummins RO, Reynolds-Haertle R, Hearne TR: Cardiac arrest and resuscitation: A tale of 29 cities. *Annals of Emergency Medicine* 1990, 19: 179-186.
18. J D Fisher, S N Brown, M W Cooke. UK Ambulance Service Clinical Practice Guidelines. Edited by Joint Royal Colleges Ambulance Liaison Committee. 2006.
19. M S Eisenberg, L Bergner, A Hallstrom (Eds):Out-of-hospital cardiac arrest: improved survival with paramedic services. In *Lancet* 1980, 812-815.
20. M S Eisenberg, M K Copass, A Hallstrom (Eds):Management of out-of-hospital cardiac arrest: failure of basic emergency medical technician services. In *JAMA* 1980, 243: 1049-1051.
21. ERC (Eds):Advanced Life Support Working Party of the European Resuscitation Council: Guidelines for adult advanced cardiac life support. In *Resuscitation* 1992, 24: 111-121.

## A comparative review of international Ambulance Service best practice

---

22. De Maio VJ, Stiell IG, Wells GA, Spaite DW: Optimal defibrillation response intervals for maximum out-of-hospital cardiac arrest survival rates. *Annals of Emergency Medicine* 2003, 42: 242-250.
23. Peter T Pons, Jason S Haukoos, Whitney Bludworth, Thomas Cribley, Kathryn A Pons, Vincent J Markovchick. Paramedic Response time: Does It Affect Patient Survival? *Acad Emerg Med* 12[7], 594-600.
24. Silverman R A, Galea S, Blaney S, Freese J, Prezant D J, Park R *et al.* (Eds):The "vertical response time": barriers to ambulance response in an urban area. In *Acad Emerg Med* 2007, 14: 772-778.
25. Morrison L J, Angelini M P, Vermeulen M, Schwartz B (Eds):Measuring the EMS patient access time interval and the impact of responding to high-rise buildings. In *Prehospital Emergency Care* 2005, 9: 14-18.
26. Campbell J P, Gratton M C, Salomone III J A, Lindholm D J, Watson W A (Eds):System implications of the ambulance arrival-to-patient contact interval on response time compliance. In *Prehosp Disast Med* 1994, 9: 230-232.
27. Schull M J, Morrison L J, Vermeulen M, Redelmeier D A (Eds):Emergency department overcrowding and ambulance transport delays for patients with chest pain. In *CMAJ* 2003, 168: 277-283.
28. Eckstein M, Chan LS: The effect of emergency department crowding on paramedic ambulance availability. *Annals of Emergency Medicine* 2004, 43: 100-105.
29. Eckstein M, Isaacs SM, Slovis CM, Kaufman BJ, Loflin JR, O'Connor RE *et al.* (Eds):Facilitating EMS turnaround intervals at hospitals in the face of receiving facility overcrowding. In *Prehospital Emergency Care* 2005, 9: 267-275.
30. Cone D C, Davidson S J, Nguyen Q (Eds):A time-motion study of the emergency medical services turnaround interval. In *Annals of Emergency Medicine* 1998, 31: 241-246.
31. Stiell IG, Wells GA, Field III BJ, Spaite DW, De Maio VJ, Ward R *et al.*: Improved Out-of-Hospital Cardiac Arrest Survival Through the Inexpensive Optimization of an Existing Defibrillation Program: OPALS Study Phase II. *JAMA: The Journal of the American Medical Association* 1999, 281: 1175-1181.
32. Myerburg RJ, Fenster J, Velez M, Rosenberg D, Lai S, Kurlansky P *et al.* (Eds):Impact of Community-Wide Police Car Deployment of Automated External Defibrillators on Survival From Out-of-Hospital Cardiac arrest. In *Circulation* 2002, 106: 1058-1064.
33. Caffrey SL, Willoughby PJ, Pepe PE, Becker LB: Public Use of Automated External Defibrillators. *N Engl J Med* 2002, 347: 1242-1247

## A comparative review of international Ambulance Service best practice

---

34. Cairns KJ, Hamilton AJ, Marshall AH, Moore MJ, Adgey AAJ, Kee F: The obstacles to maximising the impact of public access defibrillation: an assessment of the dispatch mechanism for out-of-hospital cardiac arrest. *Heart* 2008, 94: 349-353.
35. Peleg K, Pliskin JS (Eds): A Geographic Information System Simulation Model of EMS: Reducing Ambulance Response Time. In *Am J Emerg Med* 2004, 22: 164-170.
36. Ota FS, Muramatsu RS, Yoshida BH, Yamamoto LG (Eds): GPS Computer Navigators to shorten EMS response and transport times. In *Am J Emerg Med* 2001, 19: 204-205.
37. L H Brown, E B Lerner, B Larmon, T LeGassick, M Taigman: Are EMS call volume predictions based on demand pattern analysis accurate? *Prehospital Emergency Care* 2007, 11: 199-203.
38. Gossage JA, Frith DP, Carrell TWG, Damiani M, Terris J, Burnand KG (Eds): Mobile phones, in combination with a computer locator system, improve response times of emergency medical services in central London. In *Ann R Coll Surg Engl* 2008, 90: 113-116.
39. Carr BG, Caplan JM, Pryor JP, Branas CC: A Meta-Analysis of Prehospital Care Times for Trauma. *Prehospital Emergency Care* 2006, 10: 198-206.
40. Care Quality Commission. Performance Assessment 2008/2009. 2009.
41. Healthcare Commission. Performance Indicators for assessment 2007/2008. 2007.
42. J B Myers, C M Slovis, M Eckstein, J M Goodloe, S M Isaacs, J R Loflin *et al.* (Eds): Evidence-Based Performance Measures for Emergency Medical Services Systems: A Model for Expanded EMS Benchmarking. In *Prehospital Emergency Care* 2008, 12: 141-151.
43. Munk MD, White SD, Perry ML, Platt TE, Hardan MS, Stoy WA: Physician Medical Direction and Clinical Performance at an Established Emergency Medical Services System. *Prehospital Emergency Care* 2009, 13: 185-192.
44. Andersen HR, Nielsen TT, Rasmussen K, Thuesen L, Kelbaek H, Thayssen P *et al.*: A Comparison of Coronary Angioplasty with Fibrinolytic Therapy in Acute Myocardial Infarction. *N Engl J Med* 2003, 349: 733-742.
45. Widimsky P, Budesinsky T, Vorac D, Groch L, Zelizko M, Aschermann M *et al.*: Long distance transport for primary angioplasty vs immediate thrombolysis in acute myocardial infarction: Final results of the randomized national multicentre trial--PRAGUE-2. *Eur Heart J* 2003, 24: 94-104.

## A comparative review of international Ambulance Service best practice

---

46. Hubble MW, Richards ME, Jarvis R, Millikan T, Young D: Effectiveness of Prehospital Continuous Positive Airway Pressure in the Management of Acute Pulmonary Edema. *Prehospital Emergency Care* 2006, 10: 430-439.
47. Alldredge BK, Gelb AM, Isaacs SM, Corry MD, Allen F, Ulrich S *et al.*: A Comparison of Lorazepam, Diazepam, and Placebo for the Treatment of Out-of-Hospital Status Epilepticus. *N Engl J Med* 2001, 345: 631-637.
48. P O'Meara: A generic performance framework for ambulance services: an Australian health services perspective. *Journal of Emergency Primary Health Care* 2005, 3.
49. MacFarlane C, Benn CA: Evaluation of emergency medical services systems: a classification to assist in determination of indicators. *Emerg Med J* 2003, 20: 188-191.
50. Fergusson RJ, Stewart CM, Wathen CG, Moffat R, Crompton GK: Effectiveness of nebulised salbutamol administered in ambulances to patients with severe acute asthma. *Thorax* 1995, 50: 81-82.
51. Lerner EB, Billitier AJ, Lance DR, Janicke DM, Teuscher JA (Eds): Can Paramedics Safely Treat and Discharge Hypoglycemic Patients in the Field? In *Am J Emerg Med* 2003, 21: 115-120.
52. Richmond NJ, Silverman R A, Kusick M, Matallana L, Winokur (Eds): Out-of-Hospital administration of Albuterol for asthma by basic life support providers. In *Acad Emerg Med* 2005, 12: 396-403.
53. Ronning OM, Guldvog B: Should Stroke Victims Routinely Receive Supplemental Oxygen? : A Quasi-Randomized Controlled Trial. *Stroke* 1999, 30: 2033-2037.
54. Harbison J, Hossain O, Jenkinson D, Davis J, Louw SJ, Ford GA: Diagnostic Accuracy of Stroke Referrals From Primary Care, Emergency Room Physicians, and Ambulance Staff Using the Face Arm Speech Test. *Stroke* 2003, 34: 71-76.
55. K F Siler: Predicting Demand for Publicly Dispatched Ambulances in a metropolitan area. *Health Services Research* 1975, 254-263.
56. The information centre for health and social care. Ambulance Services England 2007-08. 2008.
57. G L Larkin, C A Claassen, A J Pelletier, C A Camargo J: National Study of Ambulance Transports to United States Emergency Departments: Importance of Mental Health Problems. *Prehosp Disast Med* 2006, 21: 82-90.
58. J Y Sang Ting, A M Z Chang: Path Analysis modeling indicates free transport increases ambulance use for minor indications. *Prehospital Emergency Care* 2006, 10: 476-481.

## A comparative review of international Ambulance Service best practice

---

59. M N Shah, C Glushak, T G Karrison, R Mulliken, J Walter, P D Friedmann *et al.*: Predictors of Emergency Medical Services Utilisation by elders. *Acad Emerg Med* 2003, 10: 52-58.
60. H Snooks, H Wrigley, S George, E Thomas, H Smith, A Glasper: Appropriateness of use of emergency ambulances. *J Accid Emerg Med* 1998, 15: 212-215.
61. J Dale, S Williams, T Foster, J Higgins, H Snooks, R Crouch *et al.*: Safety of telephone consultation for "non-serious" emergency ambulance service patients. *Qual Saf Health Care* 2004, 13: 363-373.
62. S C Brailsford, V A Lattimer, P Tarnaras, J C Turnbull: Emergency and on-demand health care: modelling a large complex system. *Journal of the Operational Research Society* 2004, 55: 34-42.
63. Turner J, Snooks H, Youren A, Dixon S, Fall D, Gaze S *et al.*. The costs and benefits of managing some low priority call by NHS Direct nurse advisors. 2006. National Coordinating Centre for NHS Service Delivery and Organisation Research and Development (NCCSDO).
64. O'Cathain A, Webber E, Nicholl J, Munro J, Knowles E: NHS Direct: consistency of triage outcomes. *Emerg Med J* 2003, 20: 289-292.
65. Giesen P, Ferwerda R, Tijssen R, Mokkink H, Drijver R, van den Bosch W *et al.*: Safety of telephone triage in general practitioner cooperatives: do triage nurses correctly estimate urgency? *Qual Saf Health Care* 2007, 16: 181-184.
66. Silvestri S, Rothrock SG, Kennedy D, Ladde J, Bryant M, Pagane J: Can Paramedics Accurately Identify Patients Who Do Not Require Emergency Department Care? *Prehospital Emergency Care* 2002, 6: 387-390.
67. Hauswald M: Can Paramedics Safely Decide Which Patients Do Not Need Ambulance Transport or Emergency Department Care? *Prehospital Emergency Care* 2002, 6: 383-386.
68. Clesham K, Mason S, Gray J, Walters S, Cooke V: Can emergency medical service staff predict the disposition of patients they are transporting? *Emerg Med J* 2008, 25: 691-694.
69. Department of Health. Taking Healthcare to the Patient: Transforming NHS Ambulance services. 30-6-2005.
70. Mason S, O'Keeffe C, Coleman P, Edlin R, Nicholl J: Effectiveness of emergency care practitioners working within existing emergency service models of care. *Emerg Med J* 2007, 24: 239-243.

## A comparative review of international Ambulance Service best practice

---

71. Gray JT, Walker A: Avoiding admissions from the ambulance service: a review of elderly patients with falls and patients with breathing difficulties seen by emergency care practitioners in South Yorkshire. *Emerg Med J* 2008, 25: 168-171.
72. Mason S, O'Keeffe C, Coleman P, Knowles E, Patterson M, Stride C. NEECaP: National Evaluation of Emergency Care Practitioners. 2009. NIHR SDO program.
73. M Eardley, P Everden: Change of Pace. *Health Services Journal* 2003, 113: 28-29.
74. Dixon S, Mason S, Knowles E, Colwell B, Wardrope J, Snooks H *et al.*: Is it cost effective to introduce paramedic practitioners for older people to the ambulance service? Results of a cluster randomised controlled trial. *Emerg Med J* 2009, 26: 446-451.
75. Mason S, Coleman P, Ratcliffe J, Turner J, Nicholl J. Evaluation of Emergency Care Practitioners (Phase One) For the Department of Health. 2005.
76. K Ohshige: Reduction of Ambulance Transports during a Public Awareness Campaign for Appropriate Ambulance Use. *Acad Emerg Med* 2008, 15: 289-293.
77. J F Fries, C E Koop, C E Beadle, P P Cooper, M J England, R F Greaves *et al.*: Reducing Health Care Costs by Reducing the Need and Demand for Medical Services. *NEJM* 1993, 329: 321-325.
78. Vickery DM, Kalmer H, Lowry D, Constantine M, Wright E, Loren W (Eds): Effect of self-care education program on medical visits. In *JAMA* 1983, 250: 2952-2956.





Office of the Strategic Health Authorities  
Southside, 105 Victoria Street  
London SW1E 6QT  
T: 020 7932 3700