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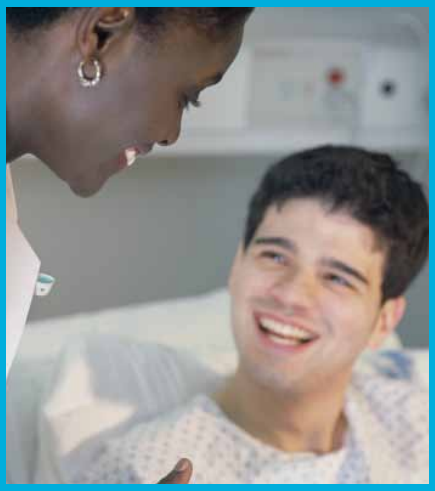

Building the evidence base in pre-hospital urgent and emergency care

A review of research evidence and priorities for future research

by the University of Sheffield
Medical Care Research Unit

DH Department of Health

Research funded by the Department of Health Policy Research Programme

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Building the evidence base in pre-hospital urgent and emergency care

A review of research evidence and priorities for future research

by the University of Sheffield
Medical Care Research Unit

Janette Turner

Evidence reviewers
Mike Bjarkoy
Patricia Coleman
Steve Goodacre
Emma Knowles
Suzanne Mason
Jon Nichol
Alicia O'Cathain
Colin O'Keeffe
Janette Turner
Richard Wilson

The University Of Sheffield.

Contents

Forewords

"We know that there is some good evidence available in pre-hospital care, but there are also significant gaps.

That was something that I highlighted in 'Taking Healthcare to the Patient: Transforming the NHS Ambulance Service', and I am delighted that this has led to the creation of this useful resource, developed by Sheffield University and funded by DH.

This is the first time that the available evidence in pre-hospital urgent and emergency care has been systematically reviewed and collected in a single document.

This is a valuable resource and a great starting point for new research in the coming years, from the smallest scale studies led by ambulance trusts to major national research projects.

It will help the NHS access the available research quickly and easily, and will help identify gaps in research which new research can tackle, helping to improve pre-hospital urgent and emergency care services.

I encourage all those involved in pre-hospital urgent and emergency care to make use of this practical resource."

Peter Bradley
DH National Director, Ambulance

"As I draw on my academic background (as well as my clinical role) to advise on DH policy, I can't emphasise strongly enough how important it is to be able to base policy on sound evidence.

I welcome this broad overview of the existing evidence in pre-hospital urgent and emergency care, which looks at what evidence is available on crucial issues from patient involvement, through understanding demand, to skills and service design.

Urgent and Emergency care is a complex area and presents huge challenges to researchers. Identifying the gaps will help to encourage future research in the areas which need it most, strengthening our evidence base for the future.

At the same time it is great to be able to use these reviews of existing studies, pulled together in one place.

This is a brilliant resource and I hope it will encourage cutting edge research in the fascinating area of urgent and emergency care."

Matthew Cooke
DH National Clinical Director, Urgent and Emergency Care

1 Introduction

What does this review do?

The Department of Health's (DH's) 2005 review *Taking Healthcare to the Patient: Transforming NHS Ambulance Services* highlighted the fact that there are gaps in the evidence base in the pre-hospital urgent and emergency care sector, and that this is therefore an area where there is good potential for future research.

DH through its Policy Research Programme has funded Sheffield University Medical Care Research Unit to produce this review of the existing evidence in pre-hospital urgent and emergency care. The views expressed are not necessarily those of the Department.

Based on an evaluation of the existing evidence and a survey of key stakeholders, this review lists the main gaps in evidence in the field, ranked by importance, with a literature review of each of the topics.

The review aims:

- **to identify the gaps in the existing evidence base in pre-hospital urgent and emergency care, in order to guide future research in this field; and**
- **to be an information resource that people can use to access existing research evidence on the topics that have been identified.**

What do the review topics cover?

The topics are listed on page 3. They cover a range of subjects including:

- Performance measurement
- Service design and delivery
- Understanding demand
- Patient involvement and access
- Staff safety

Specific clinical topics (e.g. 'how to treat patients with diabetes') were not included. More detail on how the topics were chosen is in section 3.

Who should use it?

This report is designed to be used by a range of professionals, including:

- ambulance service trusts;
- academic units and research professionals;
- research funding bodies;
- primary care trust (PCT) commissioners; and
- other emergency and urgent healthcare professionals.

How to use it

On the following page is the list of research topics, colour-coded red, amber, yellow and green.

In section 2, for each topic area there is a rapid scoping review which summarises the current research evidence for that topic area and highlights the knowledge gaps and recommendations for future research.

You can access each scoping review by clicking on the topic area from the list on the next page. A reference list is provided with each review.

Section 3 describes the methods used to carry out the project.

Less evidence available.
Good potential area for future research.

High-quality evidence available.
Less need for additional research.

See "Assessment of evidence reviews" (section 3, pages 122–125) for more information on how the evidence review topics were ranked as Red, Amber, Yellow or Green.

Research topics*

*Click on the topic to go directly to that page

2 Evidence reviews

Review 1
Patient involvement in planning of emergency care

Reviewer – Alicia O'Cathain

Background

Consumer involvement in service development and planning is a key policy for health services in England. The aim of this scoping review was to identify empirical research on how consumers/patients/the public have been involved in planning emergency medical services (EMS), and the success or otherwise of this strategy.

Methods

Search strategy

All databases listed in the Annex to this report were searched using the term 'ambulance'. Titles of projects were read to identify relevant publications. If more than 50 hits were obtained, the term 'consumer' was searched within these hits. A more sophisticated approach was taken within MEDLINE; this database was searched over the past 20 years using the terms 'emergency medical services' OR 'ambulance' OR 'pre-hospital care' AND 'health planning' OR 'consumer involvement'. A 20-year period was used because of *a priori* concerns about the lack of evidence for this topic.

Inclusion/exclusion criteria

Papers looking at emergency relief/disaster planning were excluded.

Results

MEDLINE was the only source that produced evidence. Twelve papers were identified as possibly relevant but none of these was highly relevant.

One paper offered some empirical evidence about general involvement of the public in NHS service planning and is a good starting point for any researcher who will contribute to the evidence base on this topic in EMS in the future.[1] It included a case study of redesigning health services in rural Scotland, particularly emergency cover, but focused on general aspects of involvement rather than ambulance services. It found that there was a lack of consensus about how best to involve the public, and a need to recognise the diversity of approaches to involving the public.

One paper offered some empirical evidence on planning asthma care.[2] However, the focus was on a 'collaborative community group' in the US undertaking a needs assessment and implementation plan. This sounded similar to an urgent care network in the UK, with all stakeholders working together and using mixed methods to obtain the patient experience and views of services for asthma. It was not relevant enough to our topic but the conclusions are worth noting:

- planning takes time;
- planning is a continuous process;
- involving members in planning often leads to their involvement in implementing change; and
- involving all services leads to access to relevant data.

The rest of the papers looked promising but proved to be irrelevant because they were about consulting the population on a piece of research in emergency care,[3,4,5] identified research priorities,[6] focused on disasters and emergency relief planning,[7] were about volunteers providing care,[8] were discussion papers only,[9] or their titles or abstracts identified them as not relevant.[10,11,12]

Summary

There is no research evidence on how best to involve the public in planning emergency care services.

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Review 2
Alternatives to ambulance response or transportation to A&E

Reviewer – Janette Turner

Background

A key theme of *Taking Healthcare to the Patient: Transforming NHS Ambulance Services*[1] is the development of ambulance services that provide an appropriate response to the wide range of clinical needs of patients who call 999 and request an ambulance. For patients with critical or life-threatening conditions such as stroke, acute cardiac conditions, serious injury and acute breathing problems, a rapid ambulance response and transport to hospital will always be the appropriate action. However, these types of call account for only 10% of ambulance service emergency workload and there is a desire to provide alternatives that are better matched to clinical need. The vision of *Taking Healthcare to the Patient* is that ambulance services should:

- improve the speed and quality of call handling, provide significantly more clinical advice to callers and work in a more integrated way with partner organisations to ensure consistent telephone services for patients who need urgent care;
- provide and co-ordinate an increasing range of mobile healthcare services for patients who need urgent care;
- provide an increasing range of other services, e.g. in primary care, diagnostics and health promotion; and
- continue to improve the speed and quality of services provided to patients with emergency care needs.

The purpose of this scoping review is to identify and summarise the empirical evidence of ambulance service alternatives to response or transport to an Emergency department (ED) for the generic group of non-critical patients and for the following specific patient groups:

- paediatrics;
- chronic conditions;
- mental health; and
- asthma.

Methods

Literature searches were conducted using the search strategy and sources described in section 3. Key search terms used were 'ambulance services', 'emergency medical services' (EMS), 'pre-hospital care', 'transport', 'non-transport', 'triage', and 'alternative care'. Condition-specific terms, for example 'paediatrics', were also added. The following inclusion criteria were used for selecting relevant publications:

- published within the last 15 years (1994–2009) – publications before this date were excluded to keep the current context, as the ambulance service and healthcare have changed significantly during this time;
- English language;
- reports some evaluation or comparison – descriptions of services or models with no assessment of impact or effectiveness were excluded; and
- peer reviewed and non-peer reviewed.

Results

Who should go where?

The modern health service provides a range of ambulance responses and a wide variety of healthcare options for management of urgent, unscheduled requests for medical care. Design and optimisation of pre-hospital care to achieve the objectives of *Taking Healthcare to the Patient* require a clear understanding of the nature and characteristics of calls to the ambulance service and the matching of this to an appropriate response in terms of both the ambulance response and onward management within the urgent care system. Clearly, for acute, life-threatening emergencies, transportation to hospital is the only option and although there are issues for some acute conditions (specifically myocardial infarction and stroke) regarding direct transfer to specialist units rather than ED, the focus of this review is the larger population of non-acute ambulance calls.

Although models of 'ideal' care have been developed[2,3] and alternatives to ED transportation reviewed[4] no evidence was found of any systematic analysis of the characteristics of actual ambulance service non-critical calls or mapping of the required ambulance and healthcare response within an urgent care system. The published evidence identified focused on specific responses such as non-transportation protocols or transportation to single alternative destinations.

Not transporting patients to the nearest ED requires the attending crew to make clinical decisions that are not required in a system where ED is the default management strategy. A number of studies have examined the ability of EMS personnel to identify patients who do not need to be transported to hospital in 'shadow' form; that is, to assess patients' need for transportation while still taking them to hospital. Silvestri et al.,[5] Hauswald[6] and Dunne et al.[7] conducted prospective studies in the US where paramedics were asked to rate whether or not patients required transportation to an ED. The EMS ratings were compared with prior determined criteria for transportation[5,7] or need for hospital care based on diagnosis at the ED.[6] Silvestri et al. found that paramedic assessment was 81% sensitive and 34% specific in predicting need for ED care and that 32% of the cases assessed as not requiring transportation met criteria for ED treatment. Hauswald found that agreement between paramedics' ratings and need for transportation and ED care was low (kappa = 0.47 and 0.32 respectively), and Dunne et al. estimated a positive predictive value of paramedics' assessment of ambulance need of 43.9% and negative predictive value of 60%. All authors concluded that paramedics could not safely and reliably predict which patients needed ED treatment and which could be left at home. However, in none of the studies were specific training or protocols for patient assessment for non-transportation provided, and all of the authors stated that this could make a difference to paramedic performance. These studies did not assess non-transportation in a real-life setting. Of more relevance are studies where changes in transportation policy have been implemented and tested.

Table 2a summarises publications relevant to non-transportation of patients receiving an ambulance response.

Table 2b summarises publications relevant to transportation of patients to an alternative destination.

Table 2c summarises publications relevant to telephone triage and non-response at the time of the emergency call.

Table 2a Publications relevant to non-transportation of patients receiving an ambulance response

First author, date and country	Methods	Main outcomes	Relevant results	Conclusions
Schmidt 2000[8] US	Four protocols developed to allow emergency medical technicians to categorise patient as: needs ambulance; needs ED but not ambulance; needs primary care provider; or treat and release. Total of 1,300 patients categorised prospectively by crews but all still transported. All 911 calls used.	Proportions of calls assigned to categories; presence of critical incidents indicating ambulance transportation required.	Patients categorised as: 79% need ambulance; 15% need ED by alternative means; 5% could contact primary care; 1% need treat and release. Seven cases (3%) categorised as not needing an ambulance had critical events and a further 23 may have required transportation. Sensitivity and specificity for needing ambulance transportation were 94.5% and 32.8%.	Between 3% and 11% of patients categorised as not needing transportation had critical events. Better training may reduce the miscategorisation but some under-triage will happen and services will need to decide an acceptable rate.
Persse 2002[9] US	Prospective observational study contacting non-transported patients to assess health service use and satisfaction. Results presented to paramedics as quality feedback, and patient outcomes assessed again.	Accessing medical help within 24 hours of incident; admission to hospital; decision maker (paramedic or patient); satisfaction.	Non-transportation rates and proportion of patients accessing help within 24 hours unchanged. Proportion of patients requiring admission decreased from 12.6% to 6.4% and patients declining transportation decreased from 9.3% to 3.7%. Satisfaction increased from 94.7% to 100%.	Objective feedback from non-transported patients to paramedics reduced subsequent admissions to hospital and refusals to travel, and increased patient satisfaction.

First author, date and country	Methods	Main outcomes	Relevant results	Conclusions
Gray 2007[10] UK	Non-transportation guidelines developed and implemented for four conditions – no injury; minor limb injury; resolved hypoglycaemia in known diabetic; resolved fit in known epileptic. Case review after four months.	Protocol adherence; appropriate application of protocols.	Total of 345 uses of protocols with 140 (39.5%) judged as inappropriate. Minor limb injury highest inappropriate application (51.7%). Greater adherence and appropriateness for hypoglycaemia and fits (97.1% and 95.7% appropriate). Protocols applied to 84 cases outside guidelines.	More focused guidelines produce greater adherence and can support non-transportation decisions by ambulance crews.
Schmidt 2006[11] US	Retrospective comparative review of 1,501 transported and non-transported patient runs in an EMS-initiated non-transportation system.	Chief complaint; clinical impression; 30-day mortality.	Older patients were more likely to be transported, as were patients with cardiovascular, respiratory and gastrointestinal complaints. All renal, obstetric and haematology/ oncology patients were transported. Mortality was 4.9% for transported and 1% for non-transported patients.	EMS-initiated non-transportation is predominantly determined by age and chief complaint and does not result in significant mortality.

First author, date and country	Methods	Main outcomes	Relevant results	Conclusions
Snooks 2004[12] UK	Comparative study of 23 treat-and-refer protocols for non-serious 999 calls. Outcomes of patients attended by ambulance crews trained in protocol use compared with patients where no protocols were used.	Proportion of non-transported patients; job cycle times; safety (admissions within 14 days); satisfaction.	Total of 251 intervention and 537 control cases. No difference in proportion of patients left at home (37.1% versus 36.3%) but job cycle time longer for intervention group. Satisfaction was higher in the intervention group (81% versus 58%). Three cases in each group were admitted within 14 days and judged to have required transport.	Protocol use did not increase the proportion of patients left at home. Patients valued the advice given about self-help. There were some safety issues, and decision support and training need further refinement.
Mason 2007[13] UK	Cluster randomised trial of paramedic practitioners attending elderly patients with complaints specific to scope of practice. Outcomes compared for 1,549 intervention group and 1,469 control group patients attended by standard paramedic crew.	ED attendance or hospital admission within 28 days; time from call to discharge; satisfaction.	Intervention group patients were less likely to attend ED (62.6% versus 87.5%) or require hospital admission (40.4% versus 46.5%) and total episode time was reduced by 42 minutes. There was higher reported satisfaction in the intervention group.	Paramedics with extended skills can manage patients with minor acute conditions in the community and provide an effective alternative to ED transportation and treatment.

First author, date and country	Methods	Main outcomes	Relevant results	Conclusions
Gray 2008[14] UK	Retrospective review using historical controls of elderly patients suffering from falls and breathing difficulties attended by paramedic practitioners.	ED attendance and hospital admission within 28 days.	For breathing difficulties initial ED attendance was 36% when attended by a paramedic practitioner versus 76% with historical controls. For fallers initial attendance was 26% and 51% respectively. There was an estimated admission reduction rate for paramedic practitioner calls of 46% for breathing difficulties and 56% for falls.	Paramedic practitioners can prevent ED attendances and admission by providing clinical management at point of access.
Widiatmoko 2008[15] UK	Cost-effectiveness analysis of a pilot paramedic and nurse response service for category C ambulance calls. Outcomes compared with standard ambulance response.	Conveyance rates; service costs.	Paramedic/nurse team attended 198 calls over a 13-week period. Conveyance rate of 46% and treatment rate of 54% for pilot service versus 82.5% and 17.5% for standard service. Pilot service cost an additional £286 to prevent a conveyance but there was a potential saving for the health economy.	The service reduced conveyance rates and although there were additional ambulance service costs, reduction in ED attendances and admissions produces savings for the health economy.

Table 2b Publications relevant to transportation of patients to an alternative destination

First author, date and country	Methods	Main outcomes	Relevant results	Conclusions
Shaefer 2002[16] US	Cohort study of alternative clinic-based destination for 1,016 low-acuity 911 patients compared with matched control ED transportation.	Destination of care; safety and appropriateness assessed by clinician review and patient telephone follow-up.	More patients in the alternative destination group received clinic care (8% versus 4.5%) or home care (47.4% versus 43.7%). No adverse incidents or morbidity associated with destination was detected and patients were satisfied with care.	Some low-acuity 911 patients can be safely and appropriately triaged to care in a setting other than an ED, but the proportion of eligible patients is modest. Careful protocol development and monitoring are necessary.
Snooks 2004[17] UK	Randomised study of triage and transportation to a minor injuries unit. Outcomes of 409 patients in the intervention group were compared with a control group of 425 patients transported to ED.	Destination unit; job cycle times; satisfaction.	When compared with ED attenders, those transported to a minor injuries unit were seven times more likely to rate their care as excellent and job cycle time was reduced by eight minutes. Seven patients taken to a minor injuries unit were transferred to an ED but no clinical risk was detected.	Protocol compliance was difficult and only a small proportion of patients were taken to a minor injuries unit. For these cases there were patient and ambulance service benefits.

Table 2c Publications relevant to telephone triage and non-response at the time of the emergency call

First author, date and country	Methods	Main outcomes	Relevant results	Conclusions
Smith 2001[18] US	Prospective study of providing nurse assessment for 133 non-urgent 911 ambulance calls with no immediate ambulance response.	Nurse assessment; adverse incidents; patient-reported outcomes and satisfaction.	Of assessed calls, 31% required home care, 24% were referred to a physician, 17% were referred back to 911 and 28% were referred to other resources or community reform. There were no adverse incidents and there was a high level of patient satisfaction.	Non-urgent calls can be safely transferred for nurse advice and this can reduce ambulance call-outs.
Dale 2003[19] UK	Pragmatic controlled trial of 635 non-serious (category C) 999 ambulance calls assessed by nurses and paramedics compared with 611 control cases with a standard ambulance response. For assessed calls, patients were given the option of cancelling the ambulance.	Triage decision; cancelled ambulances; ED attendance.	In the intervention group, 52% were triaged as not needing an ambulance and 36% did not attend ED – these patients were less likely to be admitted, although 30 patients did require hospital admission. Some 10% of ambulances were cancelled. Nurses were more likely than paramedics to assess as not needing an ambulance.	Triage of category C calls can lead to reduced ambulance call-outs. Further work is required on safety and cost-effectiveness.

First author, date and country	Methods	Main outcomes	Relevant results	Conclusions
Turner 2006[20] UK	Pragmatic randomised controlled trial of providing assessment of 1,766 non-serious (category C) ambulance calls by NHS Direct nurse advisers compared with 2,158 control group patients receiving a standard ambulance response followed by observational study of service in full operation.	Triage decision; return rate to ambulance service; safety; job cycle times; satisfaction; costs.	For the intervention group, there was a high return rate (67%) but this was lower for advanced medical priority dispatch system (AMPDS) Omega calls. For assessed calls, job cycle time was reduced by 9 minutes. The mis-triage rate was low, with two adverse incidents reported from a total of 3,975 calls. There was a high level of patient satisfaction.	Non-urgent 999 calls can be safely assessed for alternative care but the proportion of 999 workload not requiring a face-to-face assessment is small. Better referral pathways could increase the scope of the service. There are potential cost savings for the NHS if patients are not transported to hospital.
Cowan 2009[21] UK	Prospective observational study of GPs assessing 566 amber calls in an ambulance emergency control room and, where appropriate, suggesting an alternative response.	Triage decision; cancelled ambulances; costs.	Of the assessed calls, 131 (23%) required no response and an alternative management pathway. A total of 77 calls had no response, with the remainder receiving a response because a crew arrived before assessment was complete or the caller rang back. The service was not cost-effective, but if all calls not requiring an ambulance response complied, cost savings could be made.	There is scope for alternative management pathways for some urgent ambulance calls. GPs expressed difficulties in identifying suitable calls. The 16–19 and over 90 years age groups were least effectively helped. The ability for the assessor to refer and make routine appointments on behalf of the patient could increase effectiveness.

Table 2d Publications relevant to management of paediatric patients

First author, date and country	Methods	Main outcomes	Relevant results	Conclusions
Kost 1999[22] US	Retrospective chart analysis of paediatric patients transported to a single ED over the course of a year.	Necessary and unnecessary transportations classified by assessment criteria based on specific symptoms or incident types.	A total of 294 charts were reviewed and 28% of patients were judged to have been unnecessarily transported to ED. Of these, 60% were insured by Medicaid and these patients were significantly more likely to be transported unnecessarily to the ED than other patients. Fever was the most common cause of unnecessary transportation.	A substantial proportion of paediatric transportations to ED are clinically unnecessary and Medicaid patients account for a large proportion of these transportation.

First author, date and country	Methods	Main outcomes	Relevant results	Conclusions
Kahalé 2006[23] Canada	Prospective cohort study in a single city of characteristics and outcomes for non-transported paediatric patients.	ED visits; hospital admission; deaths.	A total of 345 cases were assessed. In almost half (46.4%) of cases, no reason was given for non-transportation, in 27% parents chose to take the child to a physician and in 25% parents chose to monitor the child. A total of 51 children were seen in an ED within 48 hours and 8.7% of these were admitted. No deaths were recorded.	Most non-transported children did not need immediate or urgent care. A small proportion required subsequent hospital care or admission. Paramedic documentation needs improvement.
Shah 2008[24] US	Descriptive study of characteristics and preferences for transportation to paediatric ED. Survey of responsible adults accompanying children to ED.	Choice of transport, alternative transport and alternatives to ED.	Surveys completed for 138 patients. EMS used because of perceived necessity (54%) and security (17%). Other methods of transportation were not considered acceptable and ED was the preferred treatment site rather than primary care, although transportation to other sites was acceptable to some.	Adults access EMS for paediatric patients for reassurance and because of concerns about the acuity of illness. Other forms of transportation were not acceptable but transportation to a different care setting was.

First author, date and country	Methods	Main outcomes	Relevant results	Conclusions
Gerlacher 2001[25] US	Cross-sectional study of non-transported paediatric patients over the course of one year with matched controls.	Demographic characteristics; chart documentation; clinical complaint.	There were 3,057 non-transported patients. The most common conditions were injury (27.7%), motor vehicle accidents (20.4%) and choking (10.2%). Non-transportation occurred less often during night hours, in children under 2 and among Hispanic patients.	Injury and injury-related incidents are the most common conditions for non-transportation. Non-transportation occurs less frequently among very young children and Hispanic patients and at night.
Haines 2006[26] US	Prospective observational study evaluating EMS-initiated non-transportation protocol for paediatric patients. Telephone follow-up to assess outcomes.	Safety; satisfaction.	A total of 704 cases were assessed over six months, with 75% completing telephone follow-up. Main-conditions were minor medical illness (43.4%) and trauma (55.9%). There were 13 subsequent hospital admissions (2.4%), but no deaths and no admissions to intensive care. Patient satisfaction was high (median five on a five-point scale).	Non-transportation protocols for paediatric patients are safe and provide a means of better utilising ambulance resources, with a high level of service user satisfaction.

Specific conditions

Searches provided no references to methods of management other than ED care for asthma patients. Similarly, no empirical evidence of management of chronic conditions was found. Some of the evidence already described for alternative management in the community[13,14,15] may have applications to chronic conditions, but these schemes were predominantly aimed at management of acute conditions, including acute exacerbations of chronic conditions.

Six papers were found that were specific to the management of paediatric patients. Of these, five papers were retrospective descriptive studies and only one reported the results of an intervention. These are given in Table 2d.

For mental health, only two relevant papers were found and both were from the US. Davis et al. reported the results of implementing a field triage protocol allowing EMS personnel to directly transport patients with primary psychiatric symptoms and no other medical or surgical condition to a psychiatric facility.[27] Over 10 months, 1,648 patients were directly transferred and, of these, 11 patients (0.66%) required transfer to an ED for further assessment but none were considered to have experienced harm from the direct transfer. More recently Cheney et al. also evaluated a direct transport protocol for psychiatric patients.[28] There were 174 direct transportations, of which 96% were effectively screened for other medical issues. Protocol non-compliance was 29% (51 cases) and one of these required hospital admission. Fourteen cases needed secondary transfer to an ED but no adverse events were detected. Both studies concluded that, with a clear protocol, paramedics can identify patients who are suitable for direct transfer to a psychiatric facility.

Summary

The evidence base for alternatives to an ambulance response or transportation to an emergency department is predominantly focused on interventions where patients can be left at home. Studies that have explored this strategy but did not discriminate by call type have demonstrated difficulties in safely and reliably identifying patients who are suitable for this type of care. Studies that have targeted low-acuity (non-urgent) calls have been more successful, particularly where clinical management has been enhanced so that appropriate assessment, treatment and referral can be made in a community setting. Similarly, enhanced clinical assessment at the time of the 999 call can also be safely implemented, although the proportion of total emergency ambulance workload that can benefit is, at present, small. However, with better integrated referral pathways there is scope for this to increase.

There have been fewer empirical studies assessing transportation of low-acuity cases to alternative destinations. The only primary research evidence found was for single studies of direct transfer to a minor injuries unit in the UK and a primary care facility in the US. In both cases the clinical risk associated with these strategies was judged to be low but it is acknowledged that success is dependent on clear assessment protocols and adequate training for those using them. There will always be some risk, although by definition this is low with non-urgent conditions, but the bigger challenge is implementing alternative transportation strategies that optimise the potential advantages by identifying all suitable patients who can benefit (rather than just some) and minimising inappropriate transportations.

There is also some evidence that patients with psychiatric symptoms can be safely transported directly to a psychiatric facility

and limited evidence from only one study that non-transportation protocols can be developed for paediatric patients.

No evidence was found of any empirical assessment of the whole clinical case-mix of emergency ambulance calls with mapping to appropriate care and services. The evidence that does exist has been derived in a piecemeal fashion, with emphasis on a particular call type, condition or response option from a pre-hospital care perspective. This clear evidence gap requires a whole emergency/urgent care systems approach that takes into account call categorisation, assessment, response and clinical management options, including services across the entire emergency ambulance call profile.

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Review 3

Reviewer – Patricia Coleman

Patient priorities and decision making when using emergency medical services (EMS) and the effectiveness of publicity campaigns in influencing patient behaviour

Background

Against the background of increasing demands for emergency ambulances in the UK,[1] there are ongoing concerns about the proportion of patients who are transported by emergency ambulances inappropriately or unnecessarily. The estimates of avoidable ambulance use range between 30% and 52%.[2] These estimates are based on various subjective and objective measures including the judgement of or clinical diagnoses by healthcare providers, or service process data (for example, investigations and treatment) applied retrospectively to the symptoms presented by the patient. Much less attention has been paid to the factors that patients have reported as influencing their decisions about whether or not to use an emergency ambulance. We have carried out a rapid review of the literature to summarise what is known about patient priorities and decision making around emergency ambulance use, and also evidence of the effectiveness of educational interventions to change behaviour.

Methods

We initiated searches of MEDLINE from 1996 to the present using the following Medical Subject Headings (MeSH) terms:

- 'decision making';
- 'patient satisfaction';
- 'health knowledge, attitudes, practice*';
- 'qualitative research';
- 'health behaviour';
- 'emergency services utilisation';
- 'primary healthcare utilisation';
- 'ambulatory care facilities utilisation';
- 'ambulances/utilisation';
- 'patient acceptance of health care';
- 'patient education as topic/methods';
- 'media campaigns';
- 'publicity campaigns';
- 'choice behaviour'; and
- 'health services misuse'.

The strategy yielded 84 potentially relevant items. These items were stored in an Endnote library. The items where abstracts

were available were scanned for salience to the topics. Given the recent changes in how ambulance services are delivered in the UK, to identify the items likely to have current relevance, the results for patient priorities and decisions to use an ambulance were limited to items published in or after 2000 AND studies that included prospective surveys of service users' views.

The results for the effectiveness of patient education on influencing ambulance use were limited to items published in or later than 2000 AND 'before' and 'after' educational intervention studies.

This strategy yielded 14 items. Copies of the full papers were obtained and these were reviewed.

Results

The literature reviewed on the appropriateness of ambulance use falls into two broad categories. Firstly, patients and users who delay or do not contact an ambulance in medical emergencies (Table 3a), and secondly, users of ambulance services whose care could be managed by a care pathway that did not involve transportation by an emergency ambulance (Table 3b). The items that focused specifically on the effectiveness of interventions to influence patient behaviour are shown in Table 3c.

The review revealed some consistent themes in patient reports of factors that influenced their help-seeking behaviour. Patients struggle to recognise symptoms as either a serious medical emergency that requires an immediate priority ambulance response, or a less serious health need that could be met by a different kind of response or service. Reports of patients feeling guilty or embarrassed to contact the ambulance service seem to be associated with inappropriate delay or non-use of ambulances. Use and non-use also appear to be associated with someone else making the decision, coping strategies and equity of access to other services.

Evidence for the effectiveness of educational interventions to increase the appropriateness of ambulance use is sparse and inconclusive. The challenge in designing an intervention is how best to target the messages so as to increase use of emergency ambulances for those with medical emergencies who would benefit from this, without also increasing use of ambulances and other emergency services by those whose needs could be managed differently.

Summary

Further patient-focused research in the UK is required into priorities and decision making about when to use or not use an emergency ambulance. There is a need to export the effectiveness of educational interventions, including their intensity and duration, the media of communication, and which groups (for example, health professionals, patients, family networks and bystanders) the intervention should be targeted towards to increase appropriate use of emergency ambulances.

Table 3a Patient priorities and decisions to use an emergency ambulance in medical emergencies

First author, date and country	Sample	Methods	Outcomes	Results	Conclusions
Morgans 2008[3] Australia	Survey of a random sample of 600 emergency department (ED) attendees stratified by urgent versus non-urgent triage category and by mode of transport (ambulance versus other).	Self-completed questionnaire (including two standardised psychological tests – Multi-dimensional Health Locus of Control (MHLOC) and Coping Responses Inventory (CPI)) and in-depth patient interviews.	Whether delays in help-seeking behaviour evident in all health emergencies (not just cardiac). Which factors influence how long it takes for patients to seek help.	Delay either under one hour or much longer than one hour. In conscious patients delay not unique to cardiac emergencies. Difficulties in recognising a medical emergency and what action should be taken. Delay predicted by gender, pain and coping strategies. Longer delays = positive adaptive coping strategies but focus on solution masks thinking about consequences of problem. Shorter delays = acceptance of limited control over problem, reappraising symptoms and action required.	The finding that help-seeking behaviour is associated with how people feel rather than what they know may explain why informative types of patient education have had limited success.
Bolivar-Munoz 2007[4] Spain	Total of 11 focus groups of persons admitted to two emergency and critical services in two referring hospitals with myocardial infarction (MI)	Group interactions and discussion regarding help-seeking behaviour.	Factors influencing decisions to use emergency ambulance or other transportation.	User/non-user of ambulance, may vary. Factors influencing decisions – eight themes: not recognising seriousness of symptoms; belief in slow progression of symptoms keeping 'self-control'; negative and positive perceptions of which transportation is quickest; previous experiences of ambulance use; shared decision with others in vicinity; ease of access to alternative transportation; avoiding stress to self and family; previous experience of MI or angina.	Health education, information and advertisements about symptoms of MI and the emergency ambulance service, targeted at potential cardiopathic patients, friends and family and primary healthcare professionals, may improve patient outcomes for MI.

First author, date and country	Sample	Methods	Outcomes	Results	Conclusions
Kerr 2006[5] Australia	Total of 105 patients admitted with acute myocardial infarction (AMI) to two hospitals bedroom October 2004 and March 2005	Semi-structured interviews and records review.	Predictors of use of emergency ambulance or other transportation.	Ambulance (46%) versus non-ambulance (54%). Ambulance use linked to: shorter interval between onset of symptoms and presentation; older age; lower income; onset at home and at weekends; sharp chest pain and severe symptoms; self-administered anginine; advice from friends and family.	Knowledge of symptoms of AMI – no effect on decision. Public education on symptoms of MI and the benefits of ambulance transportation and early treatment may improve outcomes.
Lozzi, 2005[6] Australia	Total of 215 consecutive ED patients presenting to major tertiary hospital with symptoms of MI between 1 February 2002 and March 2002	Interviews regarding help-seeking behaviour and review of hospital records.	Factors influencing decisions to use emergency ambulance or other transportation.	Ambulance (47%) versus non-ambulance (53%). Private transport 28% of confirmed MI. Ambulance use linked to: older age; previous history of ischaemic heart disease (IHD); nausea; risk factors for IHD. Non-ambulance use linked to: belief ambulance not justified by symptoms; already in car or felt taxi or private transportation would be quicker; preferences for tertiary hospital rather than nearest hospital; sought advice from GP first, costs of calling ambulance.	Threshold for calling an emergency ambulance with symptoms of IHD too high for those having first attack. Education of public and GPs may improve adherence to current recommended action for MI symptoms, i.e. call ambulance to transport to hospital.

First author, date and country	Sample	Methods	Outcomes	Results	Conclusions
Rosenfeld 2005[7] US	Total of 52 predominantly white and female aged 38–87 years with health insurance, hospitalised for first MI.	Focused semi-structured interviews.	Factors influencing patients' help-seeking behaviour following symptoms of MI	Major themes in decisions to fast-track or delay seeking help: • fast-track: recognising symptoms as cardiac and serious, needing immediate action; • delay: – attention associated with 911; – someone else taking over the decision; – seeking advice from someone else: friends, family or work supervisor; – consulting another provider, urgent or care centre physician; and – seeking advice from someone else: friends, family or work supervisor; – consulting another providr, urgent care centre or physician; and – minimising or ignoring symptoms; coping strategies; self-help.	Compared with reductions in transport time and therapy time for MI, little progress on reducing patients' decision time to seek help where most delay occurs. Interventions tailored to women's experiences may be more effective than community-based trials.
Ingarfield 2005[8] Australia	Total of 151 patients admitted to teaching hospital with angina or AMI between mid-May and mid-October 2002.	Structured focused interviews.	Factors influencing delays and why people do or do not use an emergency ambulance.	Independent predictors of delay under 30 mins: • seeking GP advice; • previous experience of heart problems; and • symptoms occurring at night. Ambulance use: • older age, called by other persons/ providers. Non-ambulance use: • symptoms not serious enough; • quicker by other transport; • someone available to drive; and • embarrassed to use ambulance.	Public and other health professional (OHP) education to stress that chest pain is a potential medical emergency requiring prompt action and a priority ambulance response. Development of GP action plan to manage chest pain patients.

First author, date and country	Sample	Methods	Outcomes	Results	Conclusions
Pattenden 2002[9] England, UK	Total of 22 patients with at least one previous MI and symptoms of another MI admitted to two district hospitals in Yorkshire.	Semi-structured interviews.	Patient experiences of MI symptoms and help-seeking behaviour.	Six themes: • recognising symptoms as MI; • perceived risk and previous experiences; • psychological and emotional factors; • beliefs (guilt) about using 999; • coping strategies; and • self-help/contacting GP first associated with longer delays to definitive care.	Knowledge of symptoms and of correct action (i.e. 999 to go direct to hospital) may not shorten decision time to seek help as an emergency.
Leslie 2000[10] Scotland, UK	Community survey of 313 (228 men, 85 women) survivors of AMI in Glasgow between October 1994 and December 1996.	Semi-structured interviews and medical records review.	Reasons for delay in seeking help during AMI symptoms and for choice of first medical contact.	Some 25% sought help within one hour of onset. Most without previous history of cardiac problems did not recognise or ignored symptoms; most first contact was to request GP to attend; belief that GP is always first course of action; reluctance to call emergency services unnecessarily; belief that symptoms not serious enough to call ambulance; tried self-help coping strategies.	Public education focused on recognising the diversity of coronary symptoms and the benefits of presenting promptly to hospital by way of emergency ambulance service may improve outcomes.

Table 3b Patient priorities and willingness to consider alternatives to transportation by emergency ambulance

First author, date and country	Sample	Methods	Outcomes	Results	Conclusion
Jacob 2008[11] US	Consecutive consenting paediatric and adult patients presenting to level 1 trauma centre.	i) Patient survey. ii) Review of medical records. iii) Physician survey.	i) Patient reasons for choice of ambulance versus non-ambulance transport to ED. ii) Unmet need. iii) Inappropriate use.	There was a 97% response to the patient survey. Ambulance use: • older and sicker; • higher patient-rated severity and nurse triage score; • admitted to hospital; • For 46% of ambulance users the ambulance was called by someone else (only reason given by most of these); • felt too sick to use any other transport; • no access to other transportation to emergency department.	Physician agreed with transport mode in 68% of decisions to use ambulance and 92% of non-ambulance use. The authors concluded that physicians' agreement with most patient choices about mode of transport indicates that most patients use ambulances appropriately. An alternative conclusion is that approximately one third of decisions to use or not use an ambulance are inappropriate.

First author, date and country	Sample	Methods	Outcomes	Results	Conclusion
Shah 2008[12] US	Convenience sample of 138 responsible adults accompanying children to paediatric trauma facility and regional referral centre.	Structured survey of patients arriving at paediatric ED by emergency ambulance.	Reasons for using an ambulance, and willingness to consider alternative transport to paediatric ED or alternative sites to paediatric ED.	Average age of children was 8 years. Although one third of presentations had an abnormal vital sign, and many had diagnostic testing and interventions, physician planned to discharge child home in 87% of cases. Reasons for ambulance use: • perceived medical necessity; and • security and speed of Emergency medical service (EMS) transport to medical care. No access to transport and waiting 24 hours for an appointment most perceived as unacceptable.	Expectation of rapid EMS ambulance response – only mode to transport child to definitive care quickly; alternative transport or not transported unacceptable. Some flexibility in location/destination in admitted and non-admitted children, indicating consumer difficulty in matching need to resources available at different types of providers such as the ED, urgent care centre and physicians' offices.

First author, date and country	Sample	Methods	Outcomes	Results	Conclusion
Yarris 2006[13] US	Total of 459 medically stable patients aged over 17 years transported by advanced life support ambulance (ALS 911) to level 1 trauma centre and able to be interviewed within two hours of arrival, May–September 2004.	Face-to-face interviews using a structured survey instrument.	i) Reasons for using an ambulance, and ii) willingness to consider alternative transport to ED or transportation to alternative provider.	69% response. Most had health insurance. i) Reasons for using ambulance: • decision by other person (including paramedic advice); • life-threatening emergency; • unsure about need to come to emergency department; • shorter waiting time in emergency department; • treatment would start sooner; • no other doctor; and • no other means of getting to ED. ii) Willingness to consider alternatives: • under 65 years; • not admitted to hospital; • user of emergency department for routine care; and • unemployed.	Acceptability of alternatives offered: • transportation to ED in car or taxi, 56%; • transport to doctor's office or clinic, 37%; • self-referral to doctor's office or clinic, 26%; • treated by paramedics and not transported, 41%; and • any alternative, 78%. Many patients transported to ED by ambulance would consider alternative transport to ED or a different facility or service, if available or offered.

Table 3c The effectiveness of educational interventions to increase appropriate use of emergency ambulances

First author, date and country	Sample	Methods	Outcomes	Results	Conclusions
Kainth 2004[14] UK	Randomised controlled trials, controlled trials and before-and-after studies.	Systematic review.	Effects of media/public education studies aimed at reducing time from onset of AMI symptoms to arrival at hospital.	A total of eleven studies: two randomised controlled trials, one controlled trial, eight before-and-after studies. Variable methodological quality. Interventions content: – importance of quick/immediate action; – signs and symptoms of AMI; – importance of calling emergency services; – emphasis of treatment; and – use of a slogan.	Limited evidence that community-wide and one-to-one educational intervention effective in reducing delay time. May have resulted in increased calls to emergency switchboards and ED visits. Properly conducted research needed to explore effectiveness and frequency and intensity of educational intervention.

First author, date and country	Criteria	Methods	Outcomes	Results	Conclusion
Grilli 2002[15] Cochrane collaboration Italy	Randomised trials, controlled clinical trials, controlled before-and-after studies and interrupted time series analyses of mass media interventions.	Cochrane systematic review.	Effects of mass media on utilisation of health services.	A total of 20 studies included – variable methodological quality. All concluded mass media were effective; not confirmed by re-analysis in 14 out of 20 studies. One study of effects of mass media interventions to reduce delays by patients with MI calling ambulance[16] reported increased ED use but no change in proportion seen with MI.	Further research needed to explore: i) whether impact of mass media is specific (leading to more appropriate use by patients who can benefit from this) or non-specific (producing volume changes in overall use without affecting appropriateness of use); ii) cost-effectiveness; iii) effects on sub-groups of population and health professionals; andiv) what type of message (content and style) is likely to be most effective.

First author, date and country	Criteria	Methods	Outcomes	Results	Conclusion
Luepker 2000[17] US	20 US cities (10 intervention; 10 control) between 1995 and 1997.	Randomised controlled trial.	Evaluate a community intervention to reduce patient delay from chest pain symptom onset to hospital presentation, and increase EMS use.	Intervention content: two central themes: • AMI symptom recognition; and • need to act fast by calling 911. Intervention via mass media, small media, community and patient groups. No difference in patient delay at baseline or follow-up between intervention and control. Increase in EMS use by patients admitted with suspected coronary heart disease (CHD) chest pain and discharged with CHD diagnosis.	Increased awareness and knowledge of programme messages. No effect on reducing patient delay from symptom onset to hospital presentation. Increased appropriate use of EMS in patients with suspected CHD.

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Review 4
Managing change resulting from service re-organisation, service development and working across service boundaries in emergency medical services (EMS)

Reviewer – Patricia Coleman

Background

In addition to the rapid response to 999 calls and transporting patients to hospital, the Department of Health report *Taking Healthcare to the Patient: Transforming NHS Ambulance Services*[1] set out a strategic vision for ambulance services to deliver high-quality call handling and clinical advice (hear and treat) and safe and effective mobile healthcare (see and treat) for a range of conditions from trauma and urgent care through to providing support for people with long-term conditions and health promotion. Implementation of the plan called for;

- good clinical and managerial leadership in a supportive environment;
- staff development through new knowledge, skills and job opportunities;
- liaising closely with patients; and
- developing effective partnerships with other health and social care organisations involved in providing good quality patient-focused care.

However, the number and complexities of the different organisations, agencies and professional groups involved in the delivery of patient care raise important questions about how best to manage the change from an organisational model of care with clear boundaries of responsibility to a problem-solving collaborative model able to be more responsive to the needs of patients.

Methods

We initiated searches of MEDLINE from 1996 to the present using the following Medical Subject Headings (MeSH) terms:

- 'emergency ambulance';
- 'working across service boundaries';
- 'managing change';
- 'service re-organisation'; and
- 'delivery of healthcare'.

Related items appearing alongside the search results were followed up. The strategy yielded 70 potentially relevant items in total. These items were stored in an Endnote library. The items where abstracts were available were scanned for salience to the topic. Given the importance of the national context in which services are provided and changes in the delivery of ambulance services signalled in *Taking Healthcare to the Patient,*[1] the results were limited to UK studies published in or after

the year 2000. This generated seven publications. Copies of the full papers were obtained for review.

Results

The seven papers included in this review are summarised in Table 4.

Recent and relevant published research evidence on managing change specifically in ambulance trusts is limited to working across service boundaries. Challenges in cross-boundary working were identified as differences in communication, language and workplace cultures; tension between the independent versus national status of different providers, for example, GP partnerships and NHS hospital doctors; triage and dispatch; and differences in structures and in management styles. Tensions between the national response time targets and innovating new ways of working in ambulance services were seen to persist. Shared vision, leadership and commitment to partnership in key individuals working across the organisations and agencies involved in unscheduled care emerged as recurring factors associated with more effective collaborative practice.

No papers reporting change management following emergency medical services (EMS) re-organisation were found. However, as an indication of some of the issues associated with re-organisation that may be transferable from one NHS setting to another, one paper examining the impact of mergers of NHS trusts[2] has been included in the review.

Conclusion

The evidence on managing change in EMS in the UK is sparse and lacks specificity. To know what works best in managing change requires detailed comparative case studies of innovations in EMS that are perceived as being implemented successfully and those that have been less successful.

Table 4 Managing change in EMS

First author and date	Aims	Methods	Outcomes	Results	Conclusions
Service re-organisation					
Fulop 2002[2]	Study of processes and impact of mergers between NHS trusts, including costs.	Cross-sectional study and case study in 13 NHS trusts: stakeholder interviews; documentary analysis.	Stated and unstated drivers and impact of merger on service delivery and development, impact on management and staff, cost savings.	Some positive enhancement and greater integration of some services (e.g. mental health). Negative effect on service delivery due to loss of management focus. Delays over 18 months in planned service developments. Tensions from tendency for one trust management team to dominate others. No improvement in recruitment or retention of staff. Differences in organisational cultures (attitude to risk-taking; innovation, outcome or process orientation; communication) created barriers to bringing organisations together. Two years after the change predicted cost savings had not been achieved.	Reconfiguration may result in unforeseen negative consequences and require greater management support than previously acknowledged.

First author and date	Aims	Methods	Outcomes	Results	Conclusions
Cross-boundary working					
Peconi 2008[3]	Scoping study to identify benefits of establishing a network for emergency and urgent care (EUC) research.	Visits to established EUC research centres. Literature review. Interviews with GP out-of-hours service. Exploring potential of routine data.	Opportunities for collaboration. Identifying gaps in knowledge. Key issues across all activities. Mechanism of implementation.	Three key issues across all activities: • working across boundaries; • patient involvement; and • triage.	Case support for a funded Thematic Research network for emergency and UnScheduled Treatment (TRUST) to support research and policy to provide a more integrated approach to patient care.
Currie, 2007[4]	Examine power relationships within systems of care that affect knowledge sharing across sectors and organisational and professional boundaries.	Longitudinal comparative case studies, using semi-structured interviews and observation, of 11 pilots to mainstream genetic services.	Structural and cultural inhibitors and mediators of change from a 'command and control' vertical structure towards partnership, networking and lateral ways of working.	Barriers: i) Jurisdictional and professional boundaries; the role of IT; extent to which referrals devolved to non-medical staff; and ii) divergent performance frameworks among organisations expected to collaborate; difficulties recruiting to 'boundary-spanning' 'hybrid' roles; specialised versus general tensions; job insecurities. Mediated by: prevalence of existing networks and relationships; incentives for behavioural change; voluntary networks, shared perspectives of problems and solutions; training and development; sensitive leadership.	Not ambulance service specific. Success relies on personal motivation of a few key people (local champions) to 'own' and be responsible for collaborative leadership across sectors, professions and organisations, drawing on divergent clinical expertise and knowledge.

First author and date	Aims	Methods	Outcomes	Results	Conclusions
Cooper 2007[5]	Observational study to quantify factors linked to positive effects on inter-professional collaborative working.	Mixed methods study of 45 interviews with emergency care practitioners (ECPs) and stakeholders and audit of 611 patients in one UK regional ambulance service over a period of 12 months.	Training levels. Time on scene. Non-conveyance rates. Referral decisions.	Training ECPs versus trained ECPs. Lower non-conveyance rates – more treat less release. Consistent correlation between good communication, teamwork and leadership and better ECP performance. Borderline trend to better leadership from level 3 ECPs implying management and leadership programmes in this group may be beneficial.	Within a collaborative and supportive network, experienced ECPs appear to have positive effects on inter-professional collaborative working.
Cooper 2007[6]	Generic study analysis to identify triggers and barriers to multi-agency and professional collaborative working in unscheduled care.	Interviews with 24 ECPs and 21 stakeholders in one UK region.	The ECP role Education and training Cultural perspectives	ECP core objective – patient treated in most appropriate place. Barriers to ECP working: differences in communication between agencies and professions; organisational and professional affiliations; and educational qualifications. Operational tensions between targets versus clinical decision time. 'Maintaining ECPs' skills when on standby. Organisational tensions (hierarchical versus 'flat' systems in collaborative working; supervision versus clinical autonomy; different work places and language cultures).	Positive benefits of ECP working: low and focused referrals; developmental links with minor injuries units; enhanced teamwork and fluency in patient care. Organisational/ educational and cultural constraints may limit collaborative working.

First author and date	Aims	Methods	Outcomes	Results	Conclusions
Haddow 2007[7]	Cross-boundary stakeholder views on new national integrated NHS-24 telephone service for unscheduled care.	Semi-structured interviews with 26 stakeholders, e.g. GP out-of-hours co-op, emergency departments (EDs), ambulance service, NHS-24, national policy makers; contextual and documentary review	Triggers and barriers to partnership working across organisational and professional divides and locations 6 months after launch.	Increasing tensions between GP out-of hours co-op and NHS-24, leading to calls by GP out-of-hours to dissolve partnership. Ambulance service and ED more conciliatory – ready to accept tensions as transitory and developmental. Differences in clinical decision making (ambulance service and ED 'one-off' patient contacts versus GP local knowledge of patient to assist decision). Ambulance service used to local delivery of national service via call centres, no dominant medical presence versus GP out-of-hours non-executive board with independent status and philosophical and financial responsibility for co-op.	The complex ownerships and identities involved in inter-professional working across boundaries need to be recognised before change processes can be effective.
Squires 2004[8]	Examine barriers to alternative response schemes being set up by ambulance service.	Interviews with 55 ambulance crew and 17 control staff in one regional ambualnce service using paramedic practitioner (PP) scheme as model of alternative response	Views of ambulance service staff on attitudes, barriers and managing change to traditional ways of working.	Support for PP scheme as good way to deal with 999 calls not needing urgent transportation. Effect on traditional ambulance service duties: one third– no effect; one third – improvement; one third – deterioration. Recurrent tensions seen between flexibility of AMPDS ambulance dispatch and targets.	Common understanding and shared vision of aims and value of alternative responses required throughout the whole of the ambulance service organisation.

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Review 5

Reviewers – Mike Bjarkoy and Janette Turner

What services and skills should be part of an emergency medical services (EMS)/pre-hospital care system that can manage high demand and varied case-mix?

Background

Pre-hospital care services have developed significantly over the last 30 years and during this time demand for services and the range of clinical conditions for which people use the ambulance service as their gateway to healthcare have also increased. In 1975 ambulance services in England responded to 1.5 million calls a year. By 2009 this had increased to over 6 million responses a year,[1] and it is estimated that only about 10% of these calls are for truly life-threatening conditions,[2] with the remainder being for urgent or non-serious health problems. Despite the apparent limited requirement for pre-hospital care for true emergencies, pre-hospital care services internationally have historically been developed and organised to meet the needs of this patient group, specifically patients with cardiac arrest and serious trauma, with a focus on speed of response.[3] The purpose of this review was to identify any empirical evidence relating to the organisational development of services and design of pre-hospital care systems that can contribute to the efficient and effective management of high demand and a varied case-mix.

Methods

Literature searches were conducted using the search strategy and sources described in section 3. Key search terms used were:

- 'ambulance services';
- 'emergency medical services';
- 'pre-hospital care';
- 'transport';
- 'demand';
- 'organisation'; and
- 'system design'.

The following inclusion criteria were used for selecting relevant publications:

- published within the last 15 years (1994–2009) – publications before this date were excluded to keep current context as the ambulance service and healthcare have changed significantly during this time;
- English language;
- reports some evaluation or comparison or description of services or models of pre-hospital care systems; and
- peer reviewed and non-peer reviewed.

Results

No studies were identified that have either modelled or empirically evaluated an integrated, whole-systems approach to the provision of pre-hospital care. Without any evidence about how a system should be designed and what services should be provided it is not possible to prescribe the skills needed to deliver these services.

There is however, a recognition set out in a number of key documents that pre-hospital care services for the future will need to be more diverse and responsive to the challenges of increased demand and varied case-mix. In the UK, a strategic review of options for the future of ambulance services in 2000[4] was a precursor to the 2005 policy document *Taking Healthcare to the Patient: Transforming NHS Ambulance Services.*[5] Around the same time similar strategic reviews and consensus papers were published in Canada (*The Future of EMS in Canada: Defining (New Road Ahead)*[6], and in the US (*Emergency Medical Services At the Crossroads)*[7]. Despite differences in the way services are currently delivered in each of these countries there is clear common purpose in the vision of pre-hospital care systems and services for the future. Each report has a clear statement of how pre-hospital care is envisaged.

Taking Healthcare to the Patient[5]

"The report sets out how ambulance services can be transformed from a service focusing primarily on resuscitation, trauma and acute care towards becoming the mobile health resource for the whole NHS – taking healthcare to the patient in the community. Ambulance services and NHS communities as a whole have already started this journey. But there is much more to do, and we need to increase the pace and consistency of progress. Best practice needs to be adopted faster and innovation needs to become a systematised part of how ambulance services do business with their health and social care partners.

The vision set out by the reference group is that over the next five years ambulance services, working with patients and the public, will:

- improve the speed and quality of call handling, provide significantly more clinical advice to callers (hear and treat), and work in a more integrated way with partner organisations to ensure consistent telephone services for patients who need urgent care;
- provide and coordinate an increasing range of mobile healthcare for patients who need urgent care (see and treat);
- provide an increasing range of other services, e.g. in primary care, diagnostics and health promotion;
- continue to improve the speed and quality of service provided to patients with emergency care needs."

The Future of EMS in Canada: Defining the New Road Ahead[6]

"Creating a vision for EMS in the future hinges on strengthening EMS foundations today, building the EMS of the future, and preparing for the complexities of tomorrow. This process will drive progress in the following areas:

- EMS will seek to become a mobile comprehensive health care service by becoming more involved in meeting the needs of the community in non-traditional areas such as injury prevention and control, public education, community health and wellness, emergency preparedness, and standardization of training and research procedures.
- Enhanced collaboration and integration with other health care providers and

community groups including emergency departments, doctors, nurses, clinics, and social services to enable research into best practices, coordinated emergency response capabilities, and more efficient utilization of health care resources.

- Funding arrangements should encourage best practices, incorporate preparedness-based funding, and provide equitable, adequate, and stable funding to all EMS regions.
- Standardized EMS training should be based on an updated and universally-accepted National Occupation and Competency Profile (NOCP) in order to enable credential portability, which will minimize potential human resource issues affecting EMS in Canada.
- Leadership development will be enhanced through credential, seniority, and benefit portability as well as continued development of flexible career pathways and graduate-level education specific to health care administration."

Emergency Medical Services: At the Crossroads[7]

"While today's emergency and trauma care system offers significantly more medical capability than was available in years past, it continues to suffer from severe fragmentation, an absence of system wide coordination, and a lack of accountability. These shortcomings diminish the care provided to emergency patients and often result in worsened medical outcomes. To address these challenges and chart a new direction for emergency and trauma care, the committee envisions a system in which all communities will be served by well-planned and highly coordinated emergency and trauma care systems that are accountable for performance and serve the needs of patients of all ages within the system.

In this new system, 9-1-1 dispatchers, emergency medical services (EMS) personnel, medical providers, public safety officers, and public health officials will be fully interconnected and united in an effort to ensure that each patient receives the most appropriate care, at the optimal location, with the minimum delay. From the patient's point of view, delivery of services for every type of emergency will be seamless. All service delivery will also be evidence-based, and innovations will be rapidly adopted and adapted to each community's needs. Hospital emergency department (ED) closures and ambulance diversions will never occur, except in the most extreme situations, such as a hospital fire or a communitywide mass casualty event. Standby capacity appropriate to each community based on its disaster risks will be embedded in the system. The performance of the system will be transparent, and the public will be actively engaged in its operation through prevention, bystander training, and monitoring of system performance."

Central to each vision is the concept of providing pre-hospital care as a system, rather than just a single service type, that can provide a flexible response to a wide range of condition types in collaboration with other related healthcare providers. However, evidence to guide how such a system should be organised is lacking. *Emergency Medical Services: At the Crossroads* specifically comments on this issue:

"Given the wide variation in EMS system models, there is broad speculation about which systems perform best and why. However, there is little evidence to support alternative models. For the most part, systems are left to their own devices to develop the arrangement that appears to work best for them.

Fire-based systems across the United States are in transition. The number of fires is

decreasing while the number of EMS calls is increasing, raising questions about system design and resource allocation. An estimated 80 per cent of fire service calls are now EMS elated. While there is little evidence to guide localities in designing their EMS systems, there is even less information on how well any system performs and how to measure that performance."

One paper has reported a Delphi study to develop a consensus opinion on the future design of EMS systems in the UK.[8] Four design factors were considered.

- Type of response to dispatch category;
- transportation options;
- enhancement of paramedic skills; and
- structure of a first responder system.

There was consensus that tiered responses should be made (advanced life support, basic life support, first response) depending on the type of call and that alternative transportation vehicles could be used for non life-threatening calls. There was also support for increasing paramedic skills and utilising other professionals from the fire and police services and community volunteers as first response options. However, the questions did not explore other options such as non-transportation and referral of patients to other agencies. The exercise was also confined to ambulance personnel so no view was given from other related health service providers.

With respect to skills, the broadest definition of pre-hospital care systems is whether the system is physician- or paramedic-based. A recent review of the international evidence on best practice for EMS found a limited number of comparative studies that have attempted to evaluate which, if any, model is superior.[9]

Comparative studies have been limited to specific conditions such as cardiac arrest and trauma and have failed to demonstrate any clear advantage of a physician model over a paramedic model. A particular problem for these types of studies is disparities in data available and the populations served and the review re-emphasises the need for prospective collaborative studies if this question is ever to be answered.

There is some evidence that changes in pre-hospital care service delivery, including changing professional roles, can have an impact in terms of meeting the variable needs of patients who request ambulances. These include alternatives to sending an ambulance response by enhanced clinical triage at the time of the call, alternatives to transportation to emergency departments and expanding the role of paramedics to provide care at home with appropriate referral. These have been examined in more detail in other reviews and can be accessed from the links below:

Review 2: Alternatives to ambulance response or transportation to A&E

Review 7: Patient assessment and management

The evidence from these studies of individual components of a pre-hospital care service can inform future system development but do not provide evidence on how a system should be organised and what combinations of services and skills are needed.

Summary

While some evidence exists on the effectiveness of individual parts of the pre-hospital care system, no studies were identified that have either modelled or empirically evaluated an integrated, whole-systems approach to the provision of

pre-hospital care which could then specify what components are needed to provide a service that can cope with both high demand and a varied case-mix.

In order to design a pre-hospital care system that can meet these criteria, a clear understanding is required of the needs of the patient population served and the types of service that can best meet these needs. A system mapping or modelling exercise of pre-hospital care case-mix, including critical care, urgent care and non-urgent care, to services required, including clinical hub (call management) and relative proportions in demand, that was then used to set out a framework for system organisation would provide a good starting point. Future service developments should be co-ordinated and evaluated within this framework and in line with the recommendations of *Taking Healthcare to the Patient* so that pre-hospital care system development is aligned with policy objectives. The UK should lead or participate in international comparative studies to improve the evidence base on pre-hospital care system design.

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Review 6 Information and performance measurement

Reviewers – Richard Wilson and Steve Goodacre

Background

This review will focus upon research into identifying outcome-based performance measures and the integrated systems needed to support outcome-based performance measurement.

Assessing performance (or measuring quality) can be approached by looking at structure, process and outcome. Two of these approaches will be considered here: performance measured by looking at processes and performance measured by looking at outcomes. For this purpose processes include such things as the treatments given or the length of time that patients wait before an ambulance arrives, whereas outcomes include such things as mortality, patient satisfaction, morbidity or the rate of adverse events. Performance measurement in pre-hospital care has up until now always focused upon response times, despite the link between these and outcomes being uncertain.

Process measurement is likely to be a more sensitive measure of performance, although we need to be sure that there is a strong link between the process measured and the outcome for the patient. As the evidence base for a lot of pre-hospital interventions is rather weak, finding good process measures can be challenging.

Outcomes are clearly important from the patient's perspective. What is problematic about outcome measures is that unless there are major differences in system performance it may be difficult to detect differences in outcome.

Methods

The following databases were searched: MEDLINE, Embase, Cumulative Index to Nursing and Allied Literature, Health Management Information Consortium, Cochrane Database of Systematic Reviews and Cochrane Controlled Trials Register, Database of Abstracts of Reviews, NHS Economic Evaluation Database and NHS Health Technology Assessment Programme. Searches were also implemented for research in progress and National Institute for Health Research publications from the Health Technology Assessment and Service Delivery and Organisation programmes, in addition to general internet searches. Searches for the 'Emergency Medical Services Outcomes Project' found five references. These all have the keywords '$$Emergency Medical Services Outcomes Project'. Citation searching was conducted on these five references. The final total of eligible papers included in the Reference Manager database was 236.

Search strategy detail is presented below in the appendix to this review.

Scrutiny of the title and abstract information for relevance to the topic resulted in a list of 14 papers that were selected for detailed review (full bibliographical details of the papers are given in the references). The results are presented below.

Table 6 Summary of papers relevant to performance measurement

First author, date and country	Type of study	Conclusions
Austin 2003[1] Canada	Statistical technique review	Compares and contrasts traditional linear regression against that of a quantile regression model. Quantile regression estimates how a specified quantile or percentile of the distribution of the outcome variable varies with patient or system characteristics. Flexibility of quantile regression models makes them well suited to out-of-hospital research.
Christofell 2002[2] US	Review (paediatric)	Discursive review of selected papers relating to outcomes research in emergency medicine and pre-hospital care, where the authors' overall concern is the paediatric element. Discussion of need to find suitable outcome measures that can be validated and standardised for paediatric use, taking into account problems of data consistency and lack of primary research. Concludes that standardised outcomes measurements are hampered by inconsistencies in data collection and a shortage of rigorous primary studies.
Clancy 2002[3] US	Review (paediatric)	MEDLINE search, 1997–2003, using terms 'children or adolescents' and 'outcomes assessment-health care'. General discussion of outcomes research in the context of children's emergency medical care. Review of literature dealing with outcomes assessment in paediatrics (four papers referred to pre-hospital care). Also makes reference to the Emergency Medical Services Outcomes Project (EMSOP). Authors identified numerous gaps in emergency medicine outcomes research. They noted the importance of developing a conceptual framework for children's emergency medical services (EMS) outcomes research, and the importance of the unique methodological issues it raises.

First author, date and country	Type of study	Conclusions
Cone 2004[4] US	Commentary	Identification of 'tracer' conditions – clinical conditions that can serve as focal points for outcomes research. Noting differences in lists of 'tracer' conditions for out-of-hospital respiratory distress, attributing those to variations in the search strategies and problems with the comprehensiveness of computerised literature searches.
Cone 2000[5] US	Commentary	Discussing the pronounced tendency in EMS research to focus on death as an outcome to the exclusion of all others. Includes pre-hospital care as well as emergency department ED care. Suggests use of the six 'D's (taken from general outcomes research) – death, disease, discomfort, disability, dissatisfaction and debt/destitution, as a means of guiding development of EMS outcomes research.
Dean 2001[6] US	Empirical research	Featuring emergency cases transported by ambulance to ED from 1994 to 1996 and the probabilistic linking of ambulance record to inpatient hospital discharge record. Outcomes were the successful linking of ambulance record to ED record; the median length of stay; and median hospital charges. Total records obtained of 165,649 emergency ambulance transports. Some 14.7% of ambulance events were linked to inpatient hospital discharges. Authors conclude that probabilistic linkage enables ambulance and hospital discharge records to be linked together and potentially increases our ability to critically evaluate EMS by providing access to hospital-based outcomes.

First author, date and country	Type of study	Conclusions
Garrison 2002[7] US	Review (EMSOP III)	The paper focuses on the role of risk-adjustment measures in out-of-hospital outcomes research. Does not discuss modelling or analytical techniques. Identifies a number of 'core' risk-adjustment measures: age; sex; ethnicity; blood pressure; pulse; respiratory rate; responsiveness; Glasgow Coma Scale; treatment timings; and impression of presenting condition. Other potential risk-adjustment measures would be condition-specific.
Graff 2004[8] US	Consensus committee deliberations	Review of literature of quality improvement in emergency medicine. No explicit concern with pre-hospital or out-of-hospital care. List of quality measures divided into four categories. Does not specifically deal with pre-hospital or out-of-hospital domain. Notes desirability of having access to aggregated patient data and recognises that hospital systems are often designed for billing (or storing laboratory and radiology data) rather than holding information suitable for outcomes assessment.
Hardern 2001[9] UK	Review	Examining standards as applied to emergency medicine and the inter-relationship of standards and quality. Does not consider pre-hospital care as a separate element. Notes that data collection is often oriented around what can be collected rather than what ought to be collected. Too often the outcomes measure used is mortality, not quality of life or morbidity. There is a need to develop models for estimating the probability of survival for non-traumatic emergencies, where these models are condition-specific. Conditions which are high-volume and with a high case fatality rate should be a priority.
Keim 2004[10] US	Review/discussion	Describes the conceptual framework and methodological considerations for out-of-hospital research. Critical of the role of the randomised controlled trial in outcomes research (the difficulty of applying findings generated in randomised controlled trials to out-of-hospital settings). Notes limitations of using existing administrative databases and the need for better designed, robust EMS databases.

First author, date and country	Type of study	Conclusions
Keim 2004[11] US	Review	Literature searches followed by expert group review. Authors examine risk-adjustment measures and outcomes measures for out-of-hospital respiratory distress and present a list of risk-adjustment measures and outcome measures. Authors conclude there is a paucity of validated risk-adjustment measures and outcomes measures.
Maio 1999[12] US	Empirical research (EMSOP I)	The first EMSOP paper is concerned with determining which conditions should be a priority for outcomes research. The authors' method was to take data from hospital EDs showing the frequency of different emergency conditions. This was sourced from a commercial emergency medical system database holding clinical data for 1995 and 1996 and obtained from EDs across the US. An expert opinion survey to assess the impact of identified conditions on different outcome categories was then undertaken. A list of clinical conditions and outcome categories that each condition might affect or impact upon was compiled, reflecting frequency of occurrence (for the condition) and the weighting assigned by the experts. Relief of discomfort was identified by professionals as having the most potential impact. Authors stress it is important to focus on studying the effect of EMS care on non-mortality outcome measures, particularly the relief of discomfort.
Maio 2002[13] US	Review (EMSOP IV)	This paper is concerned with out-of-hospital measurement of pain. The authors describe three pain measures: the Adjective Response Scale, the Numeric Response Scale, and the Oucher Scale. They conclude that the Adjective Response Scale and the Numeric Response Scale are more practically useful in an out-of-hospital setting than the Oucher Scale.

First author, date and country	Type of study	Conclusions
Spaite 2001[14] US	Review (EMSOP II)	The paper outlines a conceptual framework for future research. Two models for guiding research in EMS are described: the "Episode of Care" model, and the "Out-of-Hospital Unit of Service" model. Methodologically acceptable outcomes models for EMS are long overdue. Authors conclude that both of these models can be applied to a wide spectrum of conditions, interventions and outcomes.

Summary

There appears to be little original empirical research looking at performance measurement in the pre-hospital setting (the term 'out-of-hospital' occurs in some US papers), whether of outcome or process. As a specific locus of care, the pre-hospital setting is therefore noticeable by its absence in this literature. A frequently expressed concern, when considering outcomes from a US context, is cost. Emergency care systems, and indeed all aspects of the system, may be affected by financial difficulties resulting from lack of insurance for emergency system users.

There is one paper[9] originating in the UK. This is concerned with a discursive review of standards and quality in emergency medicine, but is not specifically focused on the pre-hospital setting. The remaining 13 papers selected are North American in origin. One[1] is statistical in its focus, reporting on quantile regression, a statistical technique it recommends for the analysis of pre-hospital research. Only one paper[6] is specifically concerned with record linkage and reports on a study attempting the probabilistic linking of hospital in-patient and ambulance computer records. Four papers[7,12,13,14] report on different aspects of the EMSOP programme, covering the setting of priorities for outcomes research, developing conceptual models for out-of-hospital outcomes research, the role of risk-adjustment in outcomes research, and pain measurement in out-of-hospital outcomes research. 'Out-of-hospital' outcomes research is the specific topic in one other paper[10] and is linked in with the EMSOP programme. Apart from the EMSOP paper, risk-adjustment features in one other paper[11] in the context of out of hospital respiratory distress. Two papers[4,5] are editorial commentaries, one (2000) arguing for the use of a wider range outcomes apart from mortality, the other (2004) discussing the use of 'tracer' conditions in EMS research. One paper[8] discusses the need for quality measurement in emergency medicine but with no mention of the pre-hospital phase. Two papers[2,3] have as their focus paediatric emergency medicine.

Overall, the evidence base here does not appear to be robust. Research evidence that is based on a rigorous evaluation is limited. The evidence here consists mostly of discursive reviews and discussions of existing published material or commentaries upon the current situation. Thus, apart from the US EMSOP work, there does not appear to be any empirical work being undertaken elsewhere. This deficiency includes research that specifically addresses the technical challenges posed by the existence of various electronic databases and how those databases may be linked.

One feature of many of these papers (with the exception of the EMSOP papers) is the emphasis placed upon the hospital end of the emergency care system and the relative lack of interest shown in the pre-hospital or out-of-hospital element. There is agreement that there is a pressing need to develop and implement measures that could be used to effectively evaluate the performance of an 'emergency medical system' and much debate about how this might be done. However, this does appear to focus almost entirely on the hospital ED, not on the ambulances that bring patients to that ED.

Furthermore, the knowledge that is available, in, for example, terms of risk-adjustment measures or outcome measures, is not strongly supported by empirical data. Reliance is placed upon consensus or expert opinion, or reviewing existing literature. The practical development and application of risk-adjustment measures for use in the pre-hospital setting does not appear to have

been undertaken. As the EMSOP writers point out, without this work it will be difficult to construct meaningful outcome measures, as differences in patient outcome due to variation in case-mix cannot be accounted for.

A significant knowledge gap is apparent in relation to the use of databases. Little work appears to be in existence explicitly addressing the problems and technical challenges involved in linking a variety of different electronic data sources. This is pertinent to the UK context. One new data source will become available with the implementation of the electronic 'Patient Report Form' to be used by ambulance services. The appearance of this new database presents the problem of how and in what way this information could be linked in with Hospital Episode Statistics for the purposes of monitoring risk-adjusted outcomes. There is also the continuing programme of upgrading the hospital information systems used within the NHS. These new systems (Millennium and Lorenzo), capturing clinical as well as administrative information, must communicate effectively not just with other parts of the NHS, like the ambulance service, but also with specialist databases such as those maintained by the Trauma Audit and Research Network (TARN) and the Myocardial Ischaemia National Audit Project (MINAP) if they are to contribute to performance measurement.

Some existing performance measurement methods, for example, both TARN and MINAP, include pre-hospital care and also measure in-hospital care.

Appendix: Search strategies

Search strategy for MEDLINE

1. 'exp emergency medical services/' (68,040);

2. 'ambulatory care/' (30,579);

3. '(emergency adj3 service$).tw.' (7,593);

4. 1 or 3 or 2 (100,006);

5. 'performance management.tw.' (201);

6. 4 and 5 (10);

7. from 6 keep 1–10 (10);

8. '*"outcome and process assessment (health care)"/' or '*"outcome assessment (health care)"/' (19,453);

9. 8 and 4 (1,081);

10. limit 9 to 'yr="2004 -Current"' (402);

11. 'ambulance.ti.' or 'ambulance.ab.' (4,222);

12. 11 and 10 (14);

13. from 12 keep 1–14 (14);

14. 'outcome based performance measure$.tw.' (4);

15. '"emergency medical services outcomes project".tw.' (5);

16. from 15 keep 1–5 (5).

Search strategy for the Health Management Information Consortium <March 2009> database

1. 'exp emergency services/' or 'exp emergency health services/' or 'exp "accident and emergency departments"/' (3,323);

2. '"patient outcome"/' (1,951);

3. 'exp health outcomes/' or 'exp clinical outcomes/' (1,564);

4. 3 or 2 (3,462);

5. 4 and 1 (57);

6. from 5 keep 1–57 (57).

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Review 7
Patient assessment and management

Reviewers – Jon Nicholl and Janette Turner

Evaluation and monitoring of safety and effectiveness including error rates, near misses and patient outcomes

Background

As ambulance services have evolved from a transportation service into a pre-hospital care service, increasingly complex decisions are required about speed of response, resources required and transportation. The emergency ambulance call-handling service must assess and prioritise calls, send appropriate and timely responses or provide alternatives such as telephone-only assessment. Transportation decisions must be made at the scene about whether to transport at all, and if so about where to take patients. Both types of decision are becomingly increasingly complex because the options available are rapidly multiplying. Developments in call prioritisation means the control room function is not simply ambulance dispatch. As emergency and urgent care systems (EUCS) have developed, there is now an increasingly complex system of specialist services to which patients can be taken or referred for further care. The purpose of this review is to assess the available evidence on the effectiveness of patient assessment and management (excluding specific clinical management) and monitoring of the safety of these decisions for three groups:

1. control room assessment;

2. near patient assessment;

3. non-transportation protocols.

Non-transportation protocols, including the use of telephone advice in the control room, are considered in detail in Review 2 and so this review will only consider control room call categorisation and near patient assessment in subsections 7.1 and 7.2 below.

An initial literature search found no papers reporting the routine measurement of errors or adverse events as a method for monitoring patient safety in the pre-hospital environment. However, adverse events have been measured as an outcome for specific research studies. These are discussed in more detail within related topics.

Review 7.1
Control room assessment

Aims

The focus of this rapid review is on the assessment process within ambulance service control rooms and specifically the effectiveness of call assessment for categorising calls.

Methods

Literature searches were conducted using the search strategy and sources described in section 3. Key search terms used were 'emergency medical dispatch' [MeSH Major Topic] or 'priority dispatch' [MeSH Major Topic] and 'effectiveness'; 'accuracy'; 'sensitivity'; and 'specificity'. The following inclusion criteria were used for selecting relevant publications:

- published within the last 15 years (1994–2009) – publications before this date were excluded to keep the current context, as the ambulance service and healthcare have changed significantly during this time;
- English language;
- reports some evaluation or comparison – descriptions of services or models with no assessment of impact or effectiveness were excluded; and
- peer reviewed and non-peer reviewed.

Table 7a Summary details of studies included in the review of control room call assessment

First author, date and country	Type of study	Study population	Methods	Outcome measures	Main findings
Wilson 2002[1] UK	Systematic review	Literature evaluating the effect of priority dispatch on patient outcome and ambulance utilisation.	Systematic review.	Papers assessed for quality using a standard 7-point scoring schedule.	Total of 326 papers identified: 64 related to ambulance prioritisation and 20 reported original data. Quality was poor with only seven papers scoring or more. Two papers supported improvement in outcome and two improved ambulance utilisation.
Nicholl 1996[2] UK	Retrospective observational study	All 999 calls to two ambulance services using criteria-based dispatch (CBD) and advanced medical priority dispatch system (AMPDS).	Epidemiological analysis of call types. Peer review of sampled cases to assess accuracy and safety of dispatch decisions.	Risk of under-and over-triage using call prioritisation.	Sensitivity for need for high-level dispatch was 55% for CBD and 44% for AMPDS. Positive predictive value (PPV) was 40% for both services. Significant under-triage (calls categorised as category C that required a category A response) was low at an estimated one call in every 2,200.

First author, date and country	Type of study	Study population	Methods	Outcome measures	Main findings
Turner 2008[3] UK	Retrospective observational study	All 999 calls to one ambulance service using NHS pathways.	Epidemiological analysis of call types and response dispositions. Peer review of cases identified as high acuity from clinical records but assigned low-priority response.	Risk of under-and over-triage using call prioritisation.	The proportion of true category A calls was estimated as 10.5% compared with the 29% actually allocated. The risk of under-triage (assigning a category B or C response to calls requiring a category A response) was low, with an estimated under-triage rate of one call in 2,583 and for serious under-triage (category C requiring a category A response) one call in 12,269.
Heward 2004[4] UK	Retrospective record review. Prospective observational study	Patients with out-of-hospital cardiac arrest.	Comparison of calls coded as cardiac arrest with actual cardiac arrest before and after implementation of AMPDS.	Accuracy of identification of cardiac arrest.	Introducing call prioritisation resulted in a 200% increase in the number of cases of cardiac arrest accurately identified at the time of the 999 call. This was related to call-taker compliance with AMPDS protocol.

First author, date and country	Type of study	Study population	Methods	Outcome measures	Main findings
Reilly 2006[5] US	Retrospective record review	Cardiac-related 911 calls in a suburban community.	Physician review of case records for patients transported to hospital with suspected cardiac problems to identify subsequent cardiac diagnosis.	Accuracy of identification of patients with cardiac emergencies.	Over three months, 104 callers had a cardiac-related problem identified. Of these, 56 were transported to hospital and 16 (28.6%) had a diagnosis of cardiac-related condition on discharge. The PPV for detecting cardiac emergency was 28.6%.
Flynn 2006[6] Australia	Retrospective record review	Calls identified as cardiac arrest by AMPDS and cardiac arrest cases identified in the Victorian ambulance service cardiac arrest registry.	Dispatch records for cardiac arrest matched with ambulance patient care record and registry record. Registry record matched to dispatch record for cases not identified at the time of the call.	Sensitivity and specificity of AMPDS protocols to detect cardiac arrest.	Sensitivity of AMPDS in detecting cardiac arrest was 76.7% and specificity was 99.2%. There is scope to reduce the number of false negatives and improve the accuracy of cardiac arrest detection.

First author, date and country	Type of study	Study population	Methods	Outcome measures	Main findings
Clawson 2008[7] UK	Retrospective descriptive study	999 calls with chest pain determinant code and cardiac arrest.	Aggregated 999 call data used to determine association between AMPDS priority levels and patient outcome of confirmed cardiac arrest by attending paramedics and blue light transport.	Relationship between priority and paramedic-confirmed cardiac arrest and high-acuity chest pain requiring blue light transport.	AMPDS high-priority advanced lift support (ALS) response priority levels were significantly associated with cardiac arrest and chest pain acuity requiring blue light transport.
Ramanujam 2008[8] US	Retrospective observational study	Stroke patients presenting within 12 hours of symptom onset and admitted to study hospitals.	Dispatch data, paramedic records and stroke registry records of confirmed hospital diagnosis of stroke used to determine accuracy of stroke recognition by emergency medical dispatch and paramedics.	Sensitivity and predictive values of stroke assessment.	Sensitivity was 83% and PPV 42% for the AMPDS stroke protocol. For paramedics using a stroke scale, sensitivity was 44% and PPV 40%.

First author, date and country	Type of study	Study population	Methods	Outcome measures	Main findings
Buck 2009[9] US	Prospective observational study	Patients transported to a study hospital.	Comparison of dispatch assessment and hospital-confirmed diagnosis of stroke for transported patients.	Diagnostic accuracy of AMPDS stroke protocol.	Of 96 patients with a hospital diagnosis of stroke or TIA, a dispatch code of potential stroke was assigned to 44.8%. Sensitivity of the stroke protocol was 0.41, specificity 0.96 and NPV 0.95.
Deakin 2009[10] UK	Retrospective record review	All patients transported to study hospital over six months.	Comparison of dispatch assessment and hospital-confirmed diagnosis of stroke for transported patients.	Diagnostic accuracy of AMPDS stroke protocol.	A total of 126 patients had a diagnosis of stroke. Sensitivity of AMPDS was 47.6% and specificity 98.6%.
Gray 2008[11] UK	Retrospective record review	All patients attended by an emergency care practitioner over a 12-month period.	Comparison of AMPDS code and outcome destination for emergency care practitioner-attended patients classified as sent to emergency department (ED), managed in the community or stood down after assessment by other crew.	Correlation between prioritisation category and use of alternative clinical dispatch.	Records were reviewed for 3,955 cases. All but two AMPDS categories were included. Alternatives to ED were used by emergency care practitioners across all categories of calls, with 36% managed in the community for category A calls, 52% for category B and 44% for category C.

First author, date and country	Type of study	Study population	Methods	Outcome measures	Main findings
Hinchey 2007[12] US	Retrospective observational study	All patients attended by emergency medical services (EMS) in a six-month period.	All calls assigned dispatch Alpha level response reviewed to identify if high-acuity conditions, defined as 'trauma triage criteria met' or 'treatment given for acute coronary syndrome'; respiratory distress; altered mental state; stroke; allergic reaction; or abnormal vital signs.	Appropriateness of assignment of low-acuity (Alpha) AMPDS dispatch codes.	Of 2,121 Alpha assigned calls meeting inclusion criteria, 21 met high-acuity criteria. An additional 14 patients were transported to hospital as emergencies and of these eight met high-acuity criteria. AMPDS identifies patients with high-acuity illness as low-acuity in only 1% of cases.

First author, date and country	Type of study	Study population	Methods	Outcome measures	Main findings
Feldman 2006[13] Canada	Retrospective observational study	All emergency ambulance calls over one year.	AMPDS dispatch priority compared with acuity scores of patients measured using the Canadian Triage and Acuity Scale (CTAS).	Sensitivity, specificity and predictive values of AMPDS protocols to detect high-acuity illness.	A total of 102,582 calls were included. Overall sensitivity of AMPDS was 68.2% and specificity was 66.2%. The breathing problem protocol was the most sensitive (100%), psychiatric most specific (98.1%) and cardiac arrest the highest PPV (92.6%). The worst-performing protocol was unknown problems and half of the protocols performed no better than chance in detecting high-acuity patients.
Shah 2005[14] US	Prospective observational study	Patients assigned one of 21 low-priority dispatch codes over one year.	All cases were assessed for low-acuity illness defined as basic life support care only or not transported using lights and sirens. Record review of cases identified as high acuity.	Predictive ability of dispatch codes to identify low-acuity illness.	There were 7,540 dispatches to low-acuity codes and 95% of these met low-acuity criteria. Eleven of the 21 codes identified low-acuity care at least 90% of the time. High-acuity illness was identified for 343 patients and 62 of these required interventions judged to have had a clinical impact.

Results

A summary of papers included is given in Table 7a. There has been one systematic review assessing the evidence on priority dispatch in ambulance control rooms in the UK.[1] The quality of the evidence was poor and the review concluded that there was very little evidence that suggested call prioritisation using AMPDS or criteria-based dispatch (CBD) has any impact on patient outcome.

There are two UK studies that have specifically examined safety and accuracy of call prioritisation systems.[2,3] Both found that the risk of serious under-triage, that is assigning a low-priority response to a high-priority call, is low, but that over-triage to high priority levels for lower-level priority calls is high, with only about 40% correctly assigned. A Canadian study has reported similar findings. Feldman[13] assessed the accuracy of call prioritisation in identifying different levels of illness acuity across all call categories and found that for half of the 32 categories the ability to detect high-acuity illness was no greater than chance, although for specific serious conditions such as cardiac arrest and breathing problems performance was much better.

Four papers were identified that have examined the accuracy of AMPDS in detecting cardiac arrest and cardiac emergencies. Introducing call prioritisation has been demonstrated to significantly improve cardiac arrest detection at the time of the call compared to no call prioritisation,[4] but up to 25% of cases are missed, indicating scope for improvement.[6] High-priority dispatch responses are significantly associated with cardiac arrest and chest pain[7] but less specific cardiac problems have a high level of over-triage.[5]

Three papers have explored recognition of stroke during the call assessment process with variable findings. One study estimated the AMPDS stroke protocol to have a sensitivity of 83% and a positive predictive value of 42%,[8] while both other studies estimated sensitivity to be 45%[9] and 47.6%.[10] All of these findings suggest there is scope to try and improve detection of stroke during the call assessment process.

A number of other studies have examined the ability of AMPDS to identify calls that are low acuity and suitable for alternative responses. These are examined in more detail in the review on alternatives to ambulance transport, but included here are studies that have measured the predictive abilities of call prioritisation. Gray[11] found calls suitable for management in the community by advanced practitioners were assigned across all call categories and were not confined to low-priority (category C) calls. Two other studies compared calls assigned low-priority responses with actual clinical outcome and found the rate of incorrect triage to be very low.[12,14]

Noticeably absent in the literature is any formal investigation of the skills and competencies required to provide emergency call-handling services that meet the needs of patients effectively. This is probably a consequence of the widespread adoption of computerised decision support systems in ambulance service control rooms. These systems have formal training, accreditation and quality assurance packages provided by the system suppliers, which have formed the basis of training and ongoing skill assessment for non-clinical emergency call handlers.[15] However, as the initial call-handling process develops into a response in its own right (hear and treat) rather than just dispatching other resources, some clarity is required about the level of clinical presence and input needed to

support this strategy. There is some limited evidence in the UK about the impact of different types of clinical staff for higher level clinical assessment of category C calls, for example by NHS Direct nurses[16] and a nurse and paramedic combination,[17] but no evaluation of the clinical skill mix required across the whole emergency call workload. A qualitative study in Sweden assessed the impact of introducing nurses into an emergency medical dispatch centre to increase medical competency for complex calls.[18] The study found that initially the non-clinical call handlers were sceptical and felt threatened by the introduction of nurses but over time came to value the additional clinical input they could make, in particular for complex medical conditions where symptoms were not clear cut. In contrast the nurses felt that urgent acute cases such as traffic accidents were the most difficult to manage and valued and learned from the call handlers' confidence in managing stressful situations over the telephone.

Although ambulance emergency call centres have varying combinations of non-clinical call handlers, paramedics and nurses, the optimal balance of clinical and non-clinical personnel in emergency call-handling operations is an area that requires further investigation and evaluation.

Summary

Call prioritisation has become a standard process in ambulance service control rooms. The system offers other advantages such as providing advice and instructions to the caller and additional information for crews en route to an incident. However, the focus of this review is safety and effectiveness. The main conclusions from the current evidence are as follows:

- Call prioritisation in ambulance control rooms is safe.
- The risk of serious under-triage of calls has been consistently estimated to be very low.
- The systems are more accurate at identifying the level of response required for specific conditions with very clear clinical signs such as cardiac arrest and chest pain.
- For many less specific conditions the ability of the systems to discriminate between high- and low-acuity illness is no better than chance.
- Systems can identify some low-acuity conditions safely, but to maintain safety there is a high level of over-triage with a large proportion of calls assigned to priorities higher than the clinical condition requires.
- There may therefore be scope to improve the accuracy of assessment to reduce over-triage and assign more calls to responses that are more clinically appropriate.
- All the assessments of potential errors from under-triage have been conducted within specific research studies.
- There is also scope to consider establishing a routine reporting mechanism for the small number of adverse events resulting from errors in the call prioritisation process which can then be used to improve the system.
- Further research is required to establish the combination of skills and competencies required to achieve the goal set out in *Taking Healthcare to the Patient* to compare approaches to call handling and establish the level of medical support necessary to maximise the effectiveness of telephone advice.

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Review 7.2
Near patient assessment

Aims

The focus of this rapid review is transportation decisions so the aims are to assess the accuracy of pre-hospital decisions about the transfer of patients, with respect to both where to take them and whether to transport them at all.

Methods

Searches were conducted of the standard databases using the following search strategy:

- *Search 1:* 'emergency medical services' [MeSH Major Topic], or 'ambulances' [MeSH Major Topic], or 'prehospital' or 'pre-hospital'; AND
- *Search 2:* 'safe' or 'safety' or 'error' or 'errors', or 'sensitivity' or 'specificity' or 'false negative' or 'false-positive$' or 'false-negative$'; AND
- *Search 3*: 'triage' or 'triaging', or 'diagnosis' or 'diagnostic' or 'prognosis' or 'prognostic', or 'decision' or 'decisions' or 'decision-making'; AND
- *Search 4*: 'scene' or 'site' or 'on-scene' or 'on-site' or 'near patient' or 'near-patient'.

A reference review was also undertaken.

Studies were considered using the same criteria outlined above for control room assessment, and if:

- they looked at accuracy of diagnosis to guide where to take patients rather than how to treat patients (group 1); or
- they examined accuracy of prediction for need for place of care such as ED, intensive care unit (ICU), or hospital admission (group 2).

A large number of studies were found in group 1 around diagnostic accuracy for diabetic hypoglycaemia, chronic obstructive puluronary disease, etc., but focused on guiding treatment. Some studies focused on clinical conditions which can benefit from specialist care, such as stroke and major trauma, and it is these conditions we have included in the scoping review.

For group 2 we focused on need for hospital admission.

A number of studies addressing these problems have been excluded because of poor reporting, poor analysis, inconsistencies and incoherence.

Findings

The findings are reported in Tables 7b and 7c.

Trauma

The surprising finding of the Lerner review[1] was that the 'gold standard' American College of Surgeons (ACS) criteria, which have been thoroughly researched, worked little better than chance (i.e. the sensitivity + specificity was little greater than 100%). The study by Sampalis, Tamim et al, using a trauma scoring system suggested that this could be improved, but the score still missed 17% of major trauma cases; reducing the threshold to avoid this problem simply reduced the specificity to unworkable levels.[2]

Stroke

The results of seven studies are shown. These have very variable results but the better quality studies show sensitivities around 90%, as well as high levels of specificity, using stroke recognition tools.

Need for hospital admission

The results of the four studies reviewed were very similar to each other. All found that sensitivity + specificity = 150%, indicating a performance substantially better than chance using paramedic judgement.

Do protocols work?

One study comparing use of field protocols with online medical control has also been included because of the strategic importance of this question. The study was not randomised but found that protocols were a cost-effective alternative to online control.

Table 7b Summary details of studies included in the review of near patient assessment

First author, date and country	Type of study	Study population	Methods	Outcome measures	Sample size
Trauma					
Lerner 2006[1]	Systematic review 1966–2005	Seriously injured trauma patients.	Systematic review of literature on the accuracy of using the American gold standard field triage criteria (the ACS criteria) of trauma patients to identify those seriously injured and needing trauma centre care.	Sensitivity, specificity and predictive values.	Five relevant articles
Qazi 1998[3] US	Prospective observational study	Paediatric trauma from road traffic accidents or falls.	Paramedics were asked whether trauma team activation was required.	Sensitivity, specificity and predictive values.	N=85
Sampalis 1996[2] Canada	Retrospective records review	Patients with injuries treated by doctors in the EMS in Montreal in 1987–88.	Pre-hospital index (PHI) (based on blood pressure, consciousness, type of injury) calculated by doctors at the scene before treatment to predict major trauma. Included all patients with PHI over 3, and 10% sample of others.	Major trauma requiring treatment at a trauma centre.	N=628
Stroke					
Kothari 1995[4] US	Retrospective records review	Patients identified by paramedics/emergency medical technicians (EMTs) as having a stroke or TIA.	Comparison of all stroke classifications from 1986 to 1990 with final hospital diagnosis.	PPV.	N=86

First author, date and country	Type of study	Study population	Methods	Outcome measures	Sample size
Ramanujam 2008[5] US	Retrospective records review	Patients identified by paramedics as having had a stroke or by hospital records or by dispatchers.	Comparison of paramedic diagnosis using the Cincinnati prehospital stroke scale (CPSS) with hospital discharge diagnosis.	Sensitivity and PPV.	N=477
Smith 1998[6] US	Retrospective records review	All patients managed by paramedics transported to two hospitals with a paramedic or hospital diagnosis of stroke or TIA.	Comparison of hospital and paramedic diagnosis.	Sensitivity and PPV.	N=81
Frendl 2009[7] US	Before-and-after study	Patients with stroke or TIA identified retrospectively from records review.	Comparison of accuracy of stroke identification before and after training in using the CPSS.	PPV.	
Bray 2005[8] Australia	Controlled before-and-after study	Stroke patients identified from hospital records.	Comparison of the sensitivity of paramedic stroke diagnosis before and after training in the use of the Melbourne ambulance stroke screen (MASS) tool, compared to paramedics not trained.	Sensitivity.	

First author, date and country	Type of study	Study population	Methods	Outcome measures	Sample size
Bray 2005[9] Australia	Prospective comparison of three pre-hospital stroke identification tools	All stroke dispatches identified from ambulance service dispatch records.	Comparison of the diagnostic accuracy of the Los Angeles prehospital stroke screen (LAPSS), the CPSS and the MASS.	Sensitivity and specificity.	
Kidwell 2000[10] US	Prospective diagnostic accuracy study	Non-comatose, non-trauma patients with complaints suggestive of neurological disease.	LAPSS used by paramedics compared with hospital diagnosis.	Sensitivity, specificity, PPV, NPV, and likelihood ratios.	
Need for admission					
Levine 2006[11] US	Prospective observational study	All patients seen by paramedics and transported to hospital during one month in 2001.	Paramedics completed a form on arrival at hospital indicating whether they predicted a patient would be admitted and, if so, to what type of ward.	Sensitivity, specificity, PPV and NPV.	N=952
Price 2005[12] US	Prospective observational study	All patients aged over 18 seen by paramedics and transported to hospital during June 1999.	Paramedics completed a form on arrival at hospital predicting patient disposition (some results are also given for EMTs which are excluded here).	Sensitivity, specificity, PPV and NPV.	N=295

First author, date and country	Type of study	Study population	Methods	Outcome measures	Sample size
Richards 1999[13] US	Prospective observational study	All patients transported by ambulance to hospital in February 1997.	EMS providers completed a form on arrival at hospital predicting admission to hospital.	Sensitivity, specificity, PPV and NPV.	N=350 (ALS) N=537 (BLS)
Clesham 2009[14] UK	Prospective observational study	Patients transported to one hospital during data collection sessions, excluding GP urgents and patients seen by emergency care practitioners.	EMS completed a questionnaire on arrival at ED predicting disposition.	Sensitivity, specificity, PPV and NPV.	N=396
Others					
Rottman 1995[15] US	Before-and-after study	People experiencing chest pain, altered level of consciousness and shortness of breath.	Comparison of accuracy of paramedic clinical assessments using online medical control (before phase) or protocols (after phase).	Agreement of on-scene assessment with final diagnosis.	N=600

Table 7c Summary details of studies included in the review of triage systems

First author, date and country	Main results	Conclusions	Comments
Trauma			
Lerner 2006[1]	Study / Sensitivity / Specificity / PPV 1 / 95% / 8% / – 2 / 97% / 8% / – 3 / – / – / 24% 4 / 57% / – / 12% 5 / 82%–92% / 31%–55% / –	There was insufficient evidence to support current gold standard field triage criteria (the ACS criteria).	The impact of triage errors was not measured. Study results were highly variable so conclusions are unreliable. Overall, however, the results appear to show that the criteria work only marginally better than chance.
Qazi 1998[3] US	Need for trauma team activation Sensitivity: 50% (9%–91%) Specificity: 88% (78%–94%) PPV: 17% (3%–49%) NPV: 97% (90%–99%)	Paramedic judgement of need for trauma team activation is not sufficiently sensitive to be of clinical use.	The small number of patients needing trauma team activation (n=12) renders the results for sensitivity and PPV unreliable.
Sampalis 1996[2] Canada	A PHI greater than 3 had 83% sensitivity and 67% specificity for identifying patients with major trauma needing treatment at a trauma centre.	PHI is a "valid and reliable" measure of injury severity as a field triage tool.	Some 17% of major trauma was missed. Unfortunately, changing the threshold to PHI ≥2 reduced specificity drastically.
Stroke			
Kothari 1995[4] US	Of patients with a pre-hospital classification of stroke, 62 out of 86 (72%) were correctly identified.	"Prehospital evaluation of potential stroke patients can be accomplished promptly".	No measure of sensitivity reported but appears to be 72%.
Ramanujam 2008[5] US	Sensitivity: 44% PPV: 40%	Dispatchers had a higher sensitivity than paramedics.	No correct measure of sensitivity available since the population studied was not complete.

First author, date and country	Main results	Conclusions	Comments
Smith 1998[6] US	Sensitivity: 49/81 (61%) PPV: 66/81 (77%)	Paramedics failed to identify 39% of stroke victims "who may have benefited from urgent therapy".	No details of outcomes or impact of false negatives.
Frendl 2009[7] US	PPV before training: 40.5% PPV after training: 38.9%	Paramedic training in the CPSS had no impact on the PPV.	
Bray 2005[8] Australia	Sensitivity of paramedics' diagnosis Before / After Using MASS: 78% / 94% Not using MASS: 78% / 80% Pre-notification of stroke arrival led to shorter times for door to medical review (31 minutes verses 15 minutes) and door to CT scan (144 minutes verses 94 minutes).	Diagnostic accuracy can be significantly improved and this improves times to care.	Small but well-designed study.
Bray 2005[9] Australia	Sensitivity / Specificity MASS: 90% / 74% CPSS: 95% / 54% LAPSS: 78% / 85% None of the 14 stroke patients missed by MASS was eligible for thrombolytic therapy.	MASS is simple to use with accurate pre-hospital identification of stroke, and stroke patients suitable for thrombolytic therapy.	
Kidwell 2000[10] US	Sensitivity: 91% Specificity: 97% PPV: 97% NPV: 98%	LAPSS allows pre-hospital personnel to identify patients with stroke to a high degree of sensitivity and specificity.	

First author, date and country	Main results	Conclusions	Comments
Need for admission			
Levine 2006[11] US	Prediction of discharge home Sensitivity: 89% (90%) Specificity: 62% (59%) PPV: 120/202 NPV: 655/730 Prediction for ICU Sensitivity: 68% Specificity: 96% PPV: 50% NPV: 98%	Paramedics have very limited ability to predict need for admission and pre-hospital diversion policies should not be based solely on paramedic determination.	
Price 2005[12] US	Prediction of discharge home Sensitivity: 76% Specificity: 80% PPV: 83% NPV: 73% Prediction for ICU Sensitivity: 78% Specificity: 91% PPV: 67% NPV: 94%	EMS providers are capable of using "selective diversion categories". Accuracy was greater for trauma patients than for medical patients.	

First author, date and country	Main results	Conclusions	Comments
Richards 1999[13] US	Hospital admission, all EMS Sensitivity: 72% Specificity: 83% PPV: 68% NPV: 85% Accuracy (PPV + NPV): ALS = 81%; BLS = 78%	EMS can predict disposition "with reasonable accuracy".	Predictive ability was best for chest pain but worst for abdominal pain and penetrating traumatic injuries. ALS and BLS may manage different patients.
Clesham 2009[14] UK	Hospital admission, all EMS Sensitivity: 72% Specificity: 77% PPV: 74% NPV: 75% Accuracy (PPV + NPV): ALS = 70%; BLS = 77%	Staff in one UK ambulance service showed "reasonable accuracy". EMS staff were significantly better at predicting admission in non-trauma than in trauma (76% versus 57%).	
Other			
Rottman 1995[15] US	Agreement of paramedic on-scene assessment with "final" diagnosis varied from 71% (protocols for shortness of breath) to 88% (protocols for chest pain). Overall, agreement was 78% over both phases.	Protocols offer a cost-effective alternative to online medical control.	There are no measures of the impact of errors in assessment, nor any analysis of the discordant pairs.

Summary

The quality of studies reviewed was generally poor, but their major limitation was the failure to address the question of how accurate is accurate enough. All triage decisions can be made as sensitive as necessary but at the cost of decreasing the specificity or PPV. That is to say, pre-hospital triage can be made to capture all or nearly all major trauma or stroke cases (that are known to benefit from specialist care) but at a cost of diverting very large numbers of patients who do not need those facilities to them. Without addressing this question of acceptable thresholds for performance, it is difficult to interpret the performance reported here.

The difference in results for three conditions that can benefit from transfer to specialist care is, however, revealing. For major trauma it is little better than chance. For stroke it is good. For myocardial infection (not reviewed here for obvious reasons) it is nearly perfect. The clear conclusion is that pre-hospital triage accuracy is completely condition-dependent.

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Review 8 Epidemiology and understanding demand for 999 ambulance services

Reviewer – Janette Turner

Background

Demand for 999 ambulance services has been increasing for many years. In the UK in 1974 the ambulance service responded to 1.5 million calls a year. By 2008/09 this had increased to over 6 million responses to 7.5 million calls.[1] Rising demand is not unique to the UK but is an international problem faced by emergency medical services (EMS) across the globe and one which shows no sign of reducing. In order to identify factors that could lead to the development of strategies to halt and ultimately reduce this trend, a clear understanding of the causes of increasing demand is required. Research that has attempted to improve understanding of the demand for ambulances is the focus of this scoping study.

Methods

Literature searches were conducted using the search strategy and sources described in section 3. Key search terms used were 'ambulance services', 'emergency medical services', 'pre-hospital care', 'demand'; 'epidemiology', '999 calls' and 'workload'. The following inclusion criteria were used for selecting relevant publications:

- published within the last 15 years (1994–2009) – publications before this date were excluded to keep the current context as the ambulance service and healthcare have changed significantly during this time;
- English language;
- reports some evaluation or comparison – descriptions of services or models with no assessment of impact or effectiveness were excluded; and
- peer reviewed and non-peer reviewed.

Results

There is a limited literature reporting empirical investigation of the causes of rising demand for ambulance services. The wider literature includes strategies for managing demand but these papers were not included as they provide no understanding of why demand continues to increase.

The relevant papers identified are summarised in Table 8.

Table 8 Summary of evidence on understanding demand for emergency ambulance services

First author, date and country	Methods	Outcome measures	Relevant results	Conclusions
Shah 2003[2] US	Prospective cohort study of elderly users of EMS: 930 patients presenting to an emergency department (ED) completed a survey.	Patient views on access to care, health beliefs and reasons for using EMS.	Thirty per cent of respondents used EMS. Reasons for using EMS included immobility (33%), illness (22%), request by others (21%), being instructed by other health services (10%) and lack of transport (10%). Predictors associated with EMS use were symptom onset less than four hours of request for help; age over 84 years; deficiencies in activities of daily living; and worse physical and social function.	The elderly population use EMS because of immobility, poor health and functioning and acute illness symptoms rather than health beliefs. Use of EMS increases with age. These factors should be taken into account by EMS providers.
Ohshige 2008[3] Japan	Retrospective time series survey of ambulance transportation workload over the 10 years 1997–2006 which included a publicity campaign about appropriate use of ambulances in 2005/06.	Trends in ambulance transportations for serious and non-serious conditions.	Monthly ambulance transportations during the campaign decreased for both serious and non-serious cases, with serious cases, decreasing by 8% and non-serious by 7%.	Public awareness campaigns can result in more appropriate ambulance use and reduce ambulance utilisation.

First author, date and country	Methods	Outcome measures	Relevant results	Conclusions
Ruger 2006[4] US	Retrospective cross-sectional study of clinical, financial and transportation characteristics of 80,000 attenders to an urban ED.	Clinical complaint, severity and acuity, length of stay and payment methods, mode of arrival.	Factors associated with ambulance use were high triage acuity; high-level illness severity; death; requirement for intensive care or operating room admission; traffic accidents; penetrating injuries; falls; social insurance (Medicare and Medicaid); arrival between midnight and 8am; and age over 64 years.	Ambulance utilisation is associated with age, severity of condition, arrival time and payer status.
McConnel 1998[5] US	Retrospective descriptive study of population and EMS utilisation data over one year.	Ambulance utilisation by age groups and for life-threatening emergencies.	Trimodal distribution of ambulance use associated with age, rising geometrically after 65 years. Age group 85+ years compared with 45–64 years had utilisation 3.4 times higher, transportation 4.5 times higher and life-threatening incidents 5.2 times higher.	An ageing society will produce increasing demands for ambulance services for medical conditions.

First author, date and country	Methods	Outcome measures	Relevant results	Conclusions
McConnel 1999[6] US	Retrospective descriptive study of population and EMS utilisation data over one year.	Utilisation compared by age, ethnic group and gender.	Unadjusted transportation rates were highest for African Americans across all age groups and genders. Age and gender standardised utilisation was lowest for non-Hispanic whites.	There are differences in ambulance utilisation by different ethnic groups with African Americans having a utilisation rate three times higher than non-Hispanic whites. Further research is required to understand if there are differences in need for services.
Svenson 2000[7] US	Retrospective observational study of EMS transport utilisation using data from a state EMS information system.	Utilisation per 1,000 population. Sub-group utilisation by age and poverty.	Mean use of EMS transport per year was 51.7 per 1,000 population but there was wide variation between communities (range 11–139/1,000/year). Highest user group was over 65 years, with utilisation increasing exponentially with age. Increased utilisation was also associated with increasing poverty, absence of a 911 service and absence of a county hospital.	Ambulance transportation is strongly associated with age and also poverty. Differences between communities make it difficult to extrapolate estimates of ambulance use using a single community measure.

First author, date and country	Methods	Outcome measures	Relevant results	Conclusions
Ting 2006[8] Australia	Before-and-after study measuring ambulance usage after the removal of direct patient fees.	Path analysis modelling of the effect of age, acuity and need for admission on ambulance users and non-users for one year before direct fees were removed and one year after.	In both years ambulance users were older, more acutely ill and had higher admission rates than non-users. Ambulance users were older, had higher acuity of illness and higher admissions in the before period. There was a negative correlation between ambulance use and severity of illness after the removal of direct payments.	Ambulance use increased after patient fees were abolished but illness severity and admissions decreased. Removing direct patient costs stimulates ambulance use and could lead to more inappropriate use.
Kawakami 2007[9] Japan	Population survey of 3,363 adults about socioeconomic characteristics, non-emergency ambulance use and EMS.	Probit modelling of associations between ambulance use and socioeconomic factors and respondents' choice for hypothetical ambulance cases.	There was a 60% response rate. Male respondents were more likely to call an ambulance for a non-emergency situation than females, as were older respondents. Possession of a car and hesitation to use ambulance services resulted in lower numbers saying they would call an ambulance for a non-emergency.	Age, gender, income and possession of a car all influence the decision to call an ambulance in a non-emergency situation.

First author, date and country	Methods	Outcome measures	Relevant results	Conclusions
Peacock 2006[10] UK	Retrospective observational study of ambulance service call volumes and population data for two years (1997 and 2002).	Call rates, population density, deprivation scores and age groups for each of 27 service areas.	There was a wide variation in call rates per 1,000 population. Significant positive relationships were found between call rates and deprivation and call rates and population density. Multivariable regression analysis showed a weaker effect of deprivation but not population density.	Areas with high population density have high ambulance call rates not explained by deprivation and the relationship was not confounded by age.
Peacock 2005[11] UK	Retrospective observational study of London ambulance service call volumes for one week in 1989, 1996 and 1999.	Calls analysed by time and day, age and sex. Call rates calculated using age/sex population estimates.	Emergency responses almost doubled between 1989 and 1999 (response rate ration 1.91). The proportion of out-of-hours calls increased from 68.8% to 71.3% (p=0.0003). Response rates increased more for males than for females and were proportionately higher for the group aged over 74 years but did not increase disproportionately in this group.	Ambulance demand doubled over 10 years in London. There was no evidence of a greater rise in demand for older people. Increased demand is not explained by demographic changes.

First author, date and country	Methods	Outcome measures	Relevant results	Conclusions
Wrigley 2002[12] UK	Retrospective observational study of ambulance dispatches in one English ambulance service using a stratified 14-day sample each year for nine years.	Call volumes; incident types; source of call (999 or GP urgent).	Calls increased by 73% over nine years, reducing to 53% after age standardisation. The largest increase by call type was sudden illness followed by cardiac and breathing problems. Calls for non-specific 'collapse' fell. GP calls remained constant but calls from the public rose from 11.8% to 20.1%.	Rises in demand cannot be attributed to additional GP calls. Patients and the public use more specific terminology to describe illness. More research is required to understand caller perceptions of urgency and the influence this has on demand.
Clark 1999[13] Australia	Prospective cross-sectional study examining factors predicting ambulance use.	Demographic, health status, method of arrival and insurance characteristics for 10,229 patients presenting to an ED over four months.	Fewer than 1% of cases were triaged as having the highest level of need and 90% used the ambulance service. Predictors of ambulance use included age over 65 years (prevalence ration (PR)=2.92); triage score level (1 or 2 PR=1.95, 3 PR=1.54); diagnosis involving mental (PR=4.29), nervous (PR=2.74) or trauma (PR=2.33); and insurance status (PR=1.54). Relationship status was also a predictor. Ethnicity, time of day and gender were not associated with usage.	Age and triage levels are the key predictors of ambulance usage but other demographic, condition and insurance status variables also have an effect.

First author, date and country	Methods	Outcome measures	Relevant results	Conclusions
Wrigley 1999[14] UK	Literature review of epidemiology and demography of 999 ambulance calls.	Published evidence relating to explanations about rise in demand for 999 ambulance services.	A total of 10 relevant papers were identified describing call characteristics; socioeconomic and demographic factors that may influence demand; and determinants of ambulance use.	Much of the published evidence used different, non-comparable methods – for example in call type classification – and provided snapshots of workload and call types rather than longitudinal changes. Some useful studies investigated the effect of demographic and socioeconomic factors but these tended to be context-specific. Variability in methods and healthcare systems make it difficult to draw robust generalisable conclusions about the reasons for increases in demand.
Department of Health 2009[15] UK	Review of evidence on demand for ambulance services and analysis of routine data.	Description of factors that characterise demand for ambulance services.	Four conditions falls, breathing problems, unconsciousness and chest pain accounted for 75% of the increase in demand for ambulance services between 2000/01 and 2007/08. There have been proportionately greater rises in the winter months (October–December) than other months.	Joint working between ambulance services and PCT commissioners is needed to address the wide range of factors that impact on demand for emergency ambulance services.

Summary

There remains limited evidence that provides any comprehensive explanation of the reasons for increases in demand for emergency ambulance services. Associations have been described with age (particularly increasing age), specific condition types and socioeconomic factors, with ability to pay and insurance status as key factors, as well as public understanding of what is and is not an emergency. Increasing demand is an international problem but an understanding of the causes may involve a combination of some general factors, particularly ageing populations and socioeconomic factors, and health system-specific factors such as access and methods of reimbursement. Much of the research provides descriptions of characteristics of ambulance service workload or predictors of ambulance usage at single time points. More recently, in the UK a practical toolkit bringing together these ideas has been developed to help services manage demand.[15] While these are useful for identifying potential factors that influence demand, they cannot answer the question about their relationship to rising demand. The small number of longitudinal studies have provided some useful indicators of influences but each has taken a different focus so the individual and combined influences of all the potential factors which may have an impact on demand remain elusive. The evidence available suggests that the reasons for increasing demand are complex and it is unlikely that single time point, small-scale studies can answer these questions. Future research efforts should move towards large-scale, longitudinal, international collaborative studies which not only identify factors that impact on demand but also show how these change over time.

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Review 9
Post-traumatic stress disorder (PTSD) in ambulance staff

Reviewers – Colin O'Keeffe and Suzanne Mason

Background

Post-traumatic stress disorder (PTSD) is a response to an acute traumatic event or series of events which is characterised by intrusive recollections, numbing of responsiveness and sensitivity to stimuli reminiscent of trauma.[1] Emergency ambulance staff are exposed to acute traumatic events in their professional role on a regular basis. Types of incident that have been described as indicating high stress situations include multiple casualty incidents and deaths in children. There are a number of predictors of PTSD described in the literature which relate to the individual, the event and the post-event period. A discussion of these predictors is beyond the scope of this report.

Aims

This review had two aims:

1. to assess the prevalence of PTSD in ambulance personnel.

2. to assess the effectiveness of interventions to treat PTSD in ambulance personnel.

Methods

Search strategy

Relevant literature was searched using a number of electronic databases (see the Annex) including MEDLINE and the Cochrane Database of Systematic Reviews and Controlled Trials Register. The search was carried out by cross-referencing search terms relevant to PTSD and emergency medical services. A comprehensive search strategy was developed for MEDLINE, Cochrane and NHS Centre for Reviews and Dissemination (NHSCRD) databases, as their search tools allowed such strategies to be developed. In other electronic sources such as Google and the National Research Register, more simplified searches using only selected keyword terms were used. Other sources were identified through the reference lists of identified articles.

Inclusion and exclusion criteria

Identified abstracts from the searches were reviewed for suitability for inclusion in the review. Primary studies or systematic reviews evaluating prevalence or interventions for PTSD were included. Abstracts that were clearly descriptive and did not include an evaluative element were excluded.

Data abstraction

The following data was abstracted from included studies:

- authors;
- year of publication;
- country;
- type of study;
- study population;
- methods;
- outcomes;
- sample size; and
- main results and conclusions.

Results

Initial screening of abstracts resulted in 20 studies that fulfilled the inclusion criteria.

Of the 20 studies for which full text versions were identified, eight were included. Twelve studies were excluded because the full text versions showed either that they were not relevant to prevalence of or interventions for PTSD, that they were descriptive studies or that they did not include ambulance personnel in their study samples. Table 9a lists the studies relating to the prevalence of PTSD; Table 9b lists those relating to interventions for PTSD.

Table 9a Prevalence of PTSD

First author, date and country	Type of study, population and sample size	Methods	Outcomes	Main results	Conclusions
Bennett 2004[2] UK	Survey of ambulance workers (paramedics and emergency medical technicians (EMTs)) –1,026 ambulance workers sampled initially.	Questionnaires.	Prevalence of PTSD on the Impact of Event Scale (IES).	A total of 617 questionnaires completed (response rate 60%); including 194 from EMTs and 380 from paramedics. Two-thirds of sample reported intrusive work-related memories. Some 22% (95%CI 19–26) reported scores indicative of PTSD. Men had higher prevalence than women (x^2 =4.67, p<0.05).	Rates of PTSD similar to those reported in other studies. Small number of women in survey means that findings on relative rates in men and women should be treated cautiously.

First author, date and country	Type of study, population and sample size	Methods	Outcomes	Main results	Conclusions
Jonsson 2003[3] Sweden	Survey of 500 ambulance emergency crew members (including medical technicians, nurses).	Questionnaires incorporating IES and the Post-Traumatic Symptom Scale (PTTS-10).	PTSD as defined by IES cut-off score of 20 and PTTS-10 cut-off score of 3 in those reporting exposure to a traumatic event.	A total of 362 questionnaires were returned (response rate 72.4%). In total, 223 reported exposure to a traumatic event. Of 223, PTSD was reported on PTTS-10 at 12% and on IES at 12%.	Emergency workers are at risk of developing PTSD in course of everyday work, even if not exposed to major disasters. Risk of under-reporting of PTSD due to avoidance behaviour and fear of exposure.
Alexander 2001[4] Scotland	Survey of 160 ambulance personnel carrying out accident and emergency duties.	Questionnaire including the GHQ-28 and IES for symptoms of PTSD given to those reporting a personally disturbing incident in last six months.	Subject scores classified as low, medium or high on IES.	A total of 110 returned the questionnaire (69% response rate). Responders comprised 40 paramedics and 70 ambulance technicians. Some 90% of sample had reported a particularly disturbing incident in previous six months. A total of 27 (30%) reported high severity scores on the IES.	High levels of PTSD symptoms.

First author, date and country	Type of study, population and sample size	Methods	Outcomes	Main results	Conclusions
van der Ploeg 2003[5] Netherlands	Longitudinal questionnaire design of 393 paramedics and drivers from 10 ambulance services.	Ambulance services selected randomly. Two time points for questionnaire measures. Respondents asked to record disturbing incidents in last five years. Common work stressors measured, including colleague support and supervisor support.	PTSD symptoms on the IES. Score of 26 or higher indicated PTSD.	A total of 221 personnel returned questionnaires at time 1 (response rate 56%); 123 responded at time 2 (response rate 31%). A total of 187 personnel at time 1 and 112 at time 2 reported experiencing at least one critical incident and therefore completed the IES. Some 12% of personnel reported PTSD at time 1 and 13% at time 2.	Social aspects of work environment are predictive of PTSD symptoms. These aspects include poor supervisor support, poor communication and poor colleague support.

First author, date and country	Type of study, population and sample size	Methods	Outcomes	Main results	Conclusions
Regehr 2002[6] Canada	Questionnaire survey of emergency service organisation in Ontario employing 800 paramedics. 86 of whom were surveyed.	Convenience sample of paramedics who reported exposure to at least one critical incident. IES used to measure PTSD. Bell Object Relations and Reality Testing Inventory (BORRTI) measured personality factors hypothesised to influence chronic PTSD.	PTSD as high or severe score on IES.	A total of 29.1% were classed as scoring high or severe on IES. Of those who had taken leave in the past due to exposure to a critical incident, 40% had current high or severe scores on IES compared with 17.2% of those not taking leave ($p<0.05$).	Personality style predicted those personnel most likely to take leave after exposure to a critical event.
Berger 2007[7] Brazil	Questionnaire survey of 234 ambulance workers.	PTSD Checklist – Civilian Version (PCL-C).	Presence of full PTSD or partial PTSD on PCL-C measure.	Full PTSD rate was 5.6%. Partial PTSD rate was 15%.	Low rates of PTSD compared with other studies likely to be due to sample including physicians (28%). Also, high proportion of military personnel are ambulance workers.

Table 9b Interventions for PTSD

First author, date and country	Type of study, population and sample size	Methods	Outcomes	Main results	Conclusions
Macnab 2003[8] Canada	Randomised controlled trial of three levels of stress debriefing, conducted on 18 paramedics and EMTs reporting critical incident stress.	Participants experiencing a critical incident and requesting critical incident stress support by contacting a study contact number were randomised to either mild, moderate or severe intervention. Questionnaires measuring acute stress reactions mailed to participants at one week, three months and six months.	IES at three and six months.	Severity of incident was categorised as mild, moderate or severe. A total of 12 subjects completed forms, of whom three (25%) were involved in mild events, five (46%) in moderate events and four (33%) in severe events. There was no correlation between severity of incident, level of intervention or PTSD (score on IES).	Critical incident stress debriefing (CISD) did not appear to affect stress symptoms. Insufficient power to demonstrate distinctions between different levels of intervention. Widespread application of CISD is not supported by present evidence. Preventive strategies such as stress management need to be explored, including routines that encourage adaptive behavioural responses.

First author, date and country	Type of study, population and sample size	Methods	Outcomes	Main results	Conclusions
Robinson 1993[9] Australia	Survey of 288 emergency hospital workers, including only 24 ambulance personnel.	A total of 288 staff took part in CISD sessions. Sessions were evaluated by a questionnaire two weeks after the session.	Bespoke questionnaire to assess value and impact of debriefing for participants on a five-point scale. Description of stress symptoms.	Overall response rate was 60%. Some 96% of emergency services personnel reported reduction in stress symptoms.	Exploratory study, limited in scope. Further research required. Crude measurements used in questionnaires.

Summary

Prevalence of PTSD

The studies in the scoping review reported a high prevalence of PTSD, with most reporting rates of around 20%. It is possible that non-responders in the studies may have been under-reporting levels of mental health distress such as PTSD due to the culture of the ambulance service and worries over anonymity and career progression. However, it is also possible that responders were over-reporting symptoms. It must be noted that many of the measures used to quantify PTSD symptoms were not diagnostic scales (such as the IES) and therefore the conclusions must be regarded with caution. The present evidence on prevalence needs to be developed so that the disability associated with PTSD symptoms is evaluated and the time course of symptoms in relation to critical events is measured. Research should take into account organisational factors that may exacerbate PTSD symptoms, including poor supervisor support, poor communication and poor colleague support.[5] Individual factors (personality and coping mechanism) have also been identified as potentially important.[10] The relative impact of work-related and individual factors in explaining variance in PTSD between ambulance workers is not known.

Interventions

This scoping review found few studies that evaluated interventions for PTSD in emergency ambulance personnel. At present, CISD is the major intervention used for this group. There is limited evidence for use or effectiveness of debriefing with emergency ambulance staff. The small number of studies included were methodologically flawed, with weak elements including small sample sizes, no controls, non-randomised allocation and inadequate timing of the interventions. Further studies are required to evaluate efficacy of CISD and other interventions. Any further studies should include an element of randomisation to intervention (CISD) and control groups, sufficient sample size, extended follow-up and adequate monitoring of the quality of the intervention.[11,12] In the absence of good evidence for CISD interventions there should be consideration given to further preventive strategies, which may include stress management routines that encourage adaptive behavioural responses.[13]

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Review 10
Workforce safety and hazards when attending emergency calls

Reviewer – Emma Knowles

Background

Healthcare professionals are exposed to a wide variety of physical and psychological hazards while undertaking their daily work. Much of the UK evidence-based literature focuses on nursing staff, while the media tends to focus on the headlines of 'violence' ("Violence costs NHS '£100m a year'"[1] and "Police to patrol with paramedics"[2]) or 'emotional stressors ("'Stressed' paramedic wins damages"[3]).

There are obvious potential hazards that are inherently related to the nature of attending emergency ambulance calls:

- There is an increased risk of road accidents due to high speeds while responding to an emergency call.
- Healthcare professionals may attend emergency calls where there is danger at the scene – either human danger (exposure to violence) or non-human danger (for example unstable conditions arising from a road traffic accident, such as broken glass or danger from damaged vehicles).
- Ambulance crew will lift and move patients, which may lead to injuries resulting from trips or falls or longer-term physical problems such as back problems.

Ambulance trusts may record safety incidents locally. However, a national dataset that provides information on the overall number of 'safety' incidents that occur does not currently exist. Therefore it is difficult to gauge if ambulance workforce safety issues are a significant problem in the UK.

This scoping review will attempt to draw on empirical data relating to the physical hazards and safety of ambulance crews when attending emergency calls.

Methods

Relevant literature was identified by searching the databases identified in the Annex.

The search was performed by cross-referencing the terms 'safety management', 'safety', 'risk assessment' and 'hazards', and with 'ambulance' and 'EMS' (emergency medical services).

Other relevant sources were identified through reference lists of the papers examined.

During the initial search of databases, inclusion criteria were:

- journal articles that were published in the English language;
- journal articles published after 1995 – it was felt that fifteen years was a reasonable cut-off date for studies relevant to this particular theme; and
- both peer reviewed and non-peer reviewed articles – it was felt that non-peer reviewed articles may have evidence-based literature listed in the reference sections.

Initially, the search focused on UK-based evidence, but it became apparent that this would result in very little evidence so the search was extended to US articles.

In addition, the search was also widened to incorporate 'research in progress' in order to identify research that had not yet reached journal publication stage.

Table 10 Evidence-based results

First author, date and country	Methods	Outcomes	Relevant results	Conclusions
Calland 2006[4] UK	Commentary.	Overview of personal safety at incident sites.	Major cause of injury is the failure to perceive the risk until it is too late. Most common cause of rescuer death is having own crash en route, and most common cause of injury, after muscle strain, is being cut by broken glass.	Training is required to perceive risks and provide skills to manage risk. No consistency between services as to what constitutes necessary personal protective equipment.
Price, 2006[5] UK	Semi-structured interviews with 20 experienced paramedics.	Paramedics' accounts of the effects on patient care and on their own health and safety of attempts to meet the eight-minute response target.	Staff report increased prevalence of musculoskeletal pain as a result of sitting in a vehicle that was deployed on standby with the aim of improving response time targets.	Strategies to meet targets are compromising health and safety of workforce.

First author, date and country	Methods	Outcomes	Relevant results	Conclusions
Saunders 2003[6] UK	Structured postal questionnaire of 200 members of general public.	Assessment of frequency and consequences of interactions between public road users and emergency ambulances.	Lights and sirens had limited effectiveness in alerting public of approaching ambulance. In most cases public move their vehicles to allow passage of emergency ambulance using lights and sirens. One third of participants found such interactions to be stressful.	Most participants interacted with emergency ambulances in a positive manner, but a significant number found such interactions difficult to handle.
Sterud 2006[7] Norway	Systematic review.	Exploration of the literature on health problems and work-related and individual health predictors in the ambulance service.	Two studies suggested that ambulance workers had a higher risk of mortality and fatal accidents than the general public. Few studies investigated physical health, especially musculoskeletal complaints, of workforce.	Different case definitions made it difficult to compare across studies.
Maguire 2005[8] US	Retrospective review of injury records among EMS personnel in two urban ambulance agencies.	Epidemiology of occupational injuries among EMS workers, calculation of injury rates and comparison of findings with other occupational groups.	Injury rate of 34.6 per 100 full-time workers per year. "Sprains, strains and tears" was leading category of injury.	Injury rates for EMS workers were higher than rates reported for workers in other industries.

First author, date and country	Methods	Outcomes	Relevant results	Conclusions
Maguire 2002[9] US	Descriptive epidemiology of occupational fatalities among EMS personnel using three national fatality databases.	Fatality rates among EMS providers compared with those of other emergency services and the general population.	Annual fatality rate of 12.7 per 100,000 EMS workers.	Fatality rate exceeded that of general population and compare with that of other emergency service workers.
Mechem 2002[10] US	Retrospective analysis of occupational injuries in a large fire department-based EMS system.	Nature and frequency of injuries resulting from assaults on paramedics and firefighters.	Some 4% of all injuries were caused by assaults. Majority of assaults occurred during patient care. Assaults resulted in need for medical attention and lost time from work.	Injuries resulting from assault were uncommon but the impact of such incidents does warrant the development of policies/ procedures to minimise these incidents.
Kahn 2001[11] US	Retrospective analysis of fatal ambulance crashes between 1987 and 1997.	Crash demographics, crash configuration, vehicle description, crash severity, and ambulance operator and vehicle occupant attributes.	Total of 339 crashes resulted in 405 fatalities and 838 injuries. Majority were during emergency use. Most crashes resulted in one fatality, who was not in the ambulance. In the ambulance, most serious injury was sustained in rear compartment and to occupants who were improperly restrained.	Crashes and fatalities were more likely to occur during emergency use and at intersections. Greater burden of injury fell on people who were not in the ambulance.

Summary

Overall, there is a distinct lack of evidence that highlights physical safety issues among the UK ambulance workforce. Evidence originating from the UK did not focus primarily on safety/hazards when attending emergency calls but highlighted findings that were relevant to this review. One study found that staff reported musculoskeletal problems as a result of sitting in their vehicle on standby as part of an effort to improve response time targets,[5] while another found that the public's behaviour when faced with "lights and sirens" could have an impact on the safety of crews when attending an emergency call.[6] Given that some members of the general public report that interactions with emergency ambulances are "difficult to handle", and because driving at high speed will inevitably increase the risk of an ambulance being involved in a road traffic accident, it may be worth examining whether a 'lights and sirens' response is appropriate in all cases. A review of advanced medical priority dispatch system (AMPDS) codes and subsequent patient disposal/outcomes may be useful in confirming that calls are assigned the most appropriate prioritisation, and therefore the correct level of ambulance response.

Research studies that relate specifically to the safety of the ambulance workforce have been undertaken in the UK. Two research studies were described on the National Research Register as being completed in 2002[12] and 2000[13] but no evidence of subsequent academic dissemination could be found.

Interest in the area of ambulance safety/personnel safety is much more prevalent in the US. Many of the articles that were identified following the initial search were derived from the US and focused on commentaries regarding local issues/initiatives rather than evaluation studies. The commentaries focused on the design of the patient compartment (including the use of a safety harness) and driving skills, rather the dangers of accidental injury on scene or violence directed towards crews. Evidence-based US studies found that EMS workers had higher rates of occupational injury and death when compared with the general public. However, a systematic review concluded that there were some uncertainties regarding the coding of injuries and estimates of the total number of ambulance workers. Studies undertaken to understand the causes of injury/fatalities report the causes being predominantly ambulance crashes rather than assault. Whether the issues raised in the US are transferable to the UK system is questionable given the operational differences between the UK and the US.

Given the lack of UK evidence, national implementation of a database recording all 'safety' incidents/physical injury within ambulance trusts is recommended. This will enable us to establish if the issue of physical safety when attending emergency ambulance calls is apparent in the UK and warrants further investigation.

Initially, ideas regarding appropriate data to collect need to be collated. Examination of ambulance service incident report forms and interviews with ambulance trust personnel would inform the development of the database. At a minimum, the dataset would include:

- time of day of the incident;
- type of incident (violence/vehicle safety/driving incident/accidental injury on scene);
- injury to persons not in the ambulance;
- type of injury resulting from the incident; and
- work days lost as a result of injury.

If, after collation and analysis of this information, it was found that physical safety issues were of concern, it would then be beneficial to look in more detail at potential gaps in knowledge and undertake evidence-based evaluation.

Search terms used

Seven relevant articles were found using reference lists only, indicating that the search terms employed were not able to effectively identify relevant literature.

For a systematic review suggested keywords are: 'occupational safety', 'accidents', 'violence' and 'wounds and injuries'.

Conclusion

There is no solid body of evidence regarding the safety and hazards when responding to an emergency ambulance call in the UK. Implementation of a national database recording safety incidents in the UK should be the first step in helping to understand whether this issue is of significance.

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Review 11
Equality of access

Reviewer – Alicia O'Cathain

Background

The focus of this scoping exercise is on differences in access to and use of services, particularly the 999 ambulance service.

Access can be measured by considering provision of services for different populations. Equality of access to emergency services is most likely to differ by geography, particularly rural versus urban differences.

Use of services is similar to the focus of the scoping exercise that covers the epidemiology of demand (review 8); that is, rates of service use by different groups. Inequality of use is likely to differ by geography, age, sex, socioeconomic group and ethnicity.

The term 'inequality' indicates differences, variations and disparities between different groups. 'Inequity' refers to those inequalities in health that are deemed to be unfair, unacceptable or related to some form of injustice.[1]

For this scoping exercise, the focus is on variation in provision and use related to need; that is, identifying groups of people who use ambulance services more or less than other groups with similar health needs.

Methods

Search strategy

All databases listed in the Annex were searched using the terms 'ambulance'. If fewer than 50 hits were obtained within a database, titles of projects were read to identify relevant publications. If more than 50 hits were obtained within a database, the terms 'equity' and 'equality' were searched within these hits. A more sophisticated approach was taken within MEDLINE; this database was searched over the past 20 years using the terms 'emergency medical services OR ambulance OR pre-hospital care' AND 'equity OR equality'. A 20-year period was used because of *a priori* concerns about the lack of evidence for this topic.

Results

Ten papers were identified, mainly in MEDLINE.

Access

Geographical variation in provision can lead to differences in access to services in the population. Population access has been studied in the US and has shown that people without access to trauma centres within 45–60 minutes' travelling time lived mainly in rural areas.[2]

Use

Urban v rural

Three papers were found that explored the urban/rural use of emergency medical services (EMS). Two studies, in Norway and Taiwan, found that the use of EMS was lower in rural than in urban areas.[3,4] Users in rural areas were also less likely to have interventions in the ambulance.[4] Urban and rural differences have also been studied for the specific symptom group of chest pain. The characteristics of patients with chest pain transported to hospital by ambulance were found to be different from those transported in other ways.[5] The analyses were undertaken separately for urban and rural areas and few differences found.

Case-mix was different in urban and rural areas and not necessarily adjusted for. Therefore these papers say little about inequity.

Age

Older and younger children were compared, and fewer younger children (aged under 5) received interventions than older children, with some adjustment for severity of case.[6]

Other papers were not relevant,[7] focused only on increase in demand[8] or differences in demand,[9] could not be obtained,[10] or were letters.[11]

Summary

There is some evidence that rural populations have less access to services than urban populations, although further work is needed on case-mix adjustment.

Table 11 Equality of access

First author, date and country	Type of study	Study population	Methods	Outcomes	Sample size	Main results	Conclusions
Branas 2005[2] US	Cross-sectional study using routine data	General population	Three databases showing geographical co-ordinates of services and population densities	Population access: percentage of population who reach trauma centres (TCs) in 45–60 minutes. Land area access: percentage of land area reachable within certain time. Role of helicopters.	US population	69%–84% had access to TCs in 45–60 minutes. Most people without access lived in rural areas.	Rural populations have less access to TCs in the US than urban populations.
Herlitz 2006[5] Sweden	Follow-up of cohort of hospital admissions	Chest pain patients	Routine data sets	Use of ambulance. Death in five years.	2,700	More people used an ambulance in urban areas than in rural areas (36% versus 44%). Older people and those with a medical history were more likely to use an ambulance; this pattern was the same in both rural and urban areas. People were more likely to die within five years if they were transported by ambulance.	People transported by ambulance are different from those transported in other ways. There are few differences between those from urban areas and those from rural areas.

First author, date and country	Type of study	Study population	Methods	Outcomes	Sample size	Main results	Conclusions
Huang 2001[4] Taiwan	Cross-sectional study of three services	Ambulance users	Routine data sets	Call volume.	Population	Call volume per 100 population was higher in urban than in rural areas. More interventions undertaken in urban area and more non-transport calls.	Pattern of ambulance use is different in urban and rural areas in Taiwan.
Suruda 1999[6] US	Cross-sectional study of one system	Children aged 0–17 using an ambulance	Routine data record linkage study	EMS response times, scene times and interventions.	Children aged 0–17	Response times and scene times similar for 0–4-year-olds and 5–17-year-olds. Interventions less frequent in younger age group: 54% versus 76%.	Younger children are less likely to receive intervention than older children.
Vaardal 2005[3] Norway	Prospective observational cohort	General population and EMS users	Routine data	Geographical differences in use of emergency number.	385,000 general population 1,035 scenes	Use of emergency number differed by geography: lower use associated with higher distance to travel.	Lower use of emergency number in rural areas than in urban areas.

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3 Study methods

Background

One of the recommendations of the Department of Health's (DH's) 2005 review of ambulance services in England, *Taking Healthcare to the Patient: Transforming NHS Ambulance Services* was that: "The Department of Health should commission a programme of work to build the evidence base for pre-hospital and out of hospital care."[1] Pre-hospital and out-of-hospital care involves an enormous number of interrelated issues concerning what care should be provided, how it should be provided and by whom. In addition, having identified 'best practice', there are also issues regarding how the quality of care and provider performance should be measured. The evidence base for pre-hospital and out-of-hospital care is not therefore just about implementing efficacious and cost-effective clinical interventions but is also concerned with identifying efficient and effective models of service delivery and robust and reliable methods of performance measurement that allow assessment of the extent to which clinical and service delivery objectives are actually realised.

The wide range and scope of issues that relate to building the evidence base for pre-hospital and out-of-hospital care requires some form of systematic assessment that identifies important gaps in knowledge. Once these have been identified, some means of prioritising the importance of these gaps is required so that DH can make appropriate and timely choices in developing a programme of research. This project has been designed to support the process of identifying the research priorities for pre-hospital and out-of-hospital care and provide the information required for further development of a research programme.

Objectives

In 2007, DH commissioned the 999 EMS Research Forum to conduct a prioritisation exercise to identify research topics that were relevant to pre-hospital care. Potential topics were identified and a meta-review carried out to establish the current evidence base. A Delphi consultation was then conducted and topics were scored, following which a list of research priorities in the field of pre-hospital care was established, ranked in order of importance.[2] A total of 96 topics were generated, grouped into five broad themes:

1. access to pre-hospital care: call handling and dispatch;
2. access to pre-hospital care: the 999 emergency response;
3. management/operations of pre-hospital services;
4. treatment in the pre-hospital environment: alternatives to ambulance response or transportation to A&E; and
5. treatment in the pre-hospital environment: clinical interventions.

The aim of this work is to build on the findings of the prioritisation exercise and generate a short, definitive list of the most

important and pressing research topics for pre-hospital and out-of-hospital care that will have a direct impact on the achievement of DH policy initiatives in this area of service delivery. The objectives are to:

- use the 999 EMS Research Forum work as a starting point and identify a list of research topics for further detailed appraisal, taking into consideration any current, ongoing research and the relevance of the topics to DH policy for urgent and emergency care;
- appraise the current evidence for each topic, including the quality of the evidence, limitations and knowledge gaps;
- construct a summary matrix linking the appraisal findings, policy objectives and a quality score to rank topics in order of importance; and
- produce a prioritised list of research topics to inform any future programme of research for pre-hospital and out-of-hospital care.

Methods

The project has been conducted in three stages:

1. refinement of the list of potential research topics to a manageable number for further assessment;
2. rapid scoping reviews of agreed topic areas to assess the current evidence base and identify knowledge gaps; and
3. quality and relevance assessment to generate a final prioritised list of research topics.

Refinement of potential research topics

The 999 EMS Research Forum prioritisation exercise identified 96 research topic areas relevant to pre-hospital and out-of-hospital care. Not all of these topics were considered priorities – for example some items were considered to already have been adequately researched and others, while acknowledged to be important, were considered to be highly specific and specialised and therefore relevant to only a small number of individuals. The aim of stage 1 was to refine and rationalise this list. This process was undertaken by the project steering group comprising:

- the project lead at the University of Sheffield (Janette Turner);
- members of the DH ambulance policy team and the DH emergency and urgent care team;
- members of the DH innovation and information team; and
- the chair of the National Ambulance Research Steering Group (Professor Niro Sirawardena).

Early on in the process the steering group took the decision to exclude clinical topics from this exercise as, although it was recognised that these are important, the focus for this study was topics relevant to policy development and implementation and service delivery. In addition, other research funding sources are available to support clinical research topics.

Removing clinical topics reduced the list of potential topics from 96 to 50. For these topics, related current or planned research was identified to avoid duplication of effort. Research in progress was also considered in the 999 EMS Research Forum work and we used these findings and updated them to take into account any newly commissioned work. This was done by:

- interrogating the National Research Register and the National Institute for Health Research website to identify relevant research using the following key search terms: ‘ambulance services’, ‘pre-hospital care’, ‘out-of-hospital care’, ‘paramedics’, ‘emergency care’ and ‘urgent care’; and

- conducting a short survey of all English ambulance trusts and academic units involved in emergency and pre-hospital care research to identify any research that may be in the process of being carried out but not funded by one of the major funding bodies.

The response rate from ambulance services was poor, with only two services returning completed surveys. Details of current and planned research were provided by Swansea University and Coventry University and these supplemented the list of related research being conducted by the research team at the University of Sheffield.

The 50 non-clinical topics were then reviewed by the project steering group. The discussions were guided by a number of principles about the focus of research that would be appropriate for a DH programme:

- the fit with current DH policy initiatives – the primary focus was the policy recommendations of *Taking Healthcare to the Patient*, but relevance to the most recent policy initiatives was taken into account, including in relation to the NHS Next Stage Review *High Quality Care for All*.[3]
- likelihood of inclusion in other related DH workstreams;
- an emphasis on NHS services; and
- the potential to produce evidence that can then be used to change and improve services and hence have some practical application.

Also taken into account were:

- the ranking of importance as determined in the prioritisation exercise; and
- any current or planned research in each topic area.

The list of 50 topics considered by the steering group was categorised under six headings:

- Emergency medical services (EMS) workforce;
- EMS organisation;
- access, demand and patient perspectives;
- EMS operations – triage and assessment;
- EMS operations – response; and
- information and performance measurement.

The full list is given in Table 3.1.

From this assessment, 18 topics were agreed for further evidence review. Some similar topic areas were merged into a single topic. The final list of agreed topics is given in Table 3.2.

Table 3.1 Initial potential topics considered for a pre-hospital care research programme

999 EMS Research Forum rank	Topic area
	EMS workforce
12	Training of paramedics in primary care skills
34	Skills and competencies in the EMS workforce
37	Effectiveness of community resuscitation schemes
39	Costs and benefits of provision of basic life support and defibrillation by other emergency services, e.g. fire, police
45	Occupational stress and post-traumatic stress in ambulance personnel: prevalence and effectiveness of interventions
54	Costs and benefits of first responder schemes
55	Use of doctors in pre-hospital settings, e.g. rapid response vehicles, helicopters
67	Workforce safety – hazards in attending emergency calls
70	Skills requirement of air ambulance medical staff (e.g. paramedics, doctors)
	EMS organisation
35	Effectiveness and efficiency of the current model (post re-organisation) of ambulance services
47	Impact of public access defibrillators
49	System benefits and costs of helicopter ambulance operations
53	Services that should be part of EMS Resources that should be provided
62	Management/operations of pre-hospital services: working across service boundaries
78	Single contact point (i.e. one telephone number) for unscheduled or emergency care
79	Leadership in EMS
91	Managing change in EMS, e.g. service re-organisation, service development

999 EMS Research Forum rank	Topic area
	Access, demand and patient perspective
6	Developing interventions to appropriately manage the increase in 999 calls
16	Causes and epidemiology of the rise in demand for emergency calls
26	Variations and inequalities in access
38	Understanding how services are being used
66	Service user decision making when choosing how to access services
69	Priorities of service users related to emergency and unscheduled care
74	Effects of changing GP contracts on unscheduled care services
87	User participation and involving patients in the planning of emergency care
93	Effectiveness of publicity campaigns for appropriate use of the 999 service
	EMS operations – triage and assessment
14	Development and validation of clinical assessment systems (including decision support tools) for triage by need and urgency
24	Effectiveness and availability of telephone advice for non-urgent 999 callers
56	Issue of who should triage in the ambulance call centre (e.g. nurses, paramedics etc.)
	EMS operations – response
9	Alternatives to ambulance response or transportation to A&E for stroke
11	Alternatives to ambulance response or transportation to A&E – issue of who should get treated where and by whom: 999, A&E, minor injuries units (MIUs), NHS Direct, GP out-of-hours services
17	Alternatives to ambulance response or transportation to A&E: falls
19	Alternatives to ambulance response or transportation to A&E: asthma and respiratory failure due to chronic obstructive pulmonary disease
23	Alternatives to ambulance response or transportation to A&E: cardiac patients for primary interventions

999 EMS Research Forum rank	Topic area
28	Alternatives to ambulance response or transportation to A&E: major trauma
29	Alternatives to ambulance response or transportation to A&E: paediatric patients
30	Alternatives to ambulance response or transportation to A&E: chronic conditions
42	Alternatives to ambulance response or transportation to A&E: mental health
57	Alternatives to ambulance response or transportation to A&E: patients with hip fractures
58	Alternatives to ambulance response or transportation to A&E: minor treatment centres
75	Alternatives to ambulance response or transportation to A&E: hypoglycaemia
52	Effects of helicopter ambulances on health outcomes for seriously injured patients
64	Issue of how helicopters can best be targeted to serious blunt trauma
84	Evaluation of telephone instructions (for whom to whom?) for on-site care
	Information and performance measurement
1	Development of EMS performance measures other than response times for use in performance management, audit and research
5	Methods for combining information on pre-hospital care and patient outcomes across ambulance service and other healthcare organisations
25	Data collection – issue of what should be in the EMS patient report form and how it should be collected
61	Costs and benefits of registries, e.g. for cardiac arrest, diabetic patients, Myocardial Ischaemia National Audit Project (MINAP), etc.
63	Costs and benefits of a national electronic patient report form
81	Integration of clinical assessment systems across services

Table 3.2 Agreed list of research areas for further evidence review

1.	**Understanding the EMS organisation**
1a	Services that should be part of an EMS/pre-hospital care system that can manage high demand and varied case-mix
1b	Epidemiology of demand and causes for increased use
1c	Managing change in EMS, e.g. service re-organisation, service development, working across service boundaries
2.	**Understanding how services are being used**
2a	Patient priorities and decision making when choosing to access services, and effectiveness of publicity campaigns
2b	Involvement in planning of emergency care
2c	Equality of access
3.	**EMS workforce**
3a	Workforce development and understanding the range of skills and professionals needed to provide the pre-hospital care system
3b	Prevalence of post-traumatic stress disorder (PTSD) in ambulance personnel and effectiveness of interventions
3c	Safety and hazards in attending emergency calls
4.	**Patient assessment and management**
	Evaluation and monitoring of safety and effectiveness, including error rates, near misses and patient outcomes, for the following:
4a	Control room, including telephone advice
4b	Near patient
4c	Non-transportation protocols
5.	**Alternatives to ambulance response or transportation to A&E**
5a	Issue of who should get treated where and by whom: 999, A&E, MIU, NHS Direct, GP out-of-hours services. Map to whole pre-hospital care system and for the following specific patient groups:
5b	Paediatric patients
5c	Chronic conditions
5d	Mental health
6.	**Information and performance measurement**
6a	Further development of outcome-based performance measures linked to (4) above
6b	Development of integrated information systems within and across services to support (4) and (6a) above

Evidence reviews

The next stage was to conduct more detailed reviews of current evidence for each of the final agreed topic areas. Clearly it was not possible to conduct a full systematic review for the 18 topics within the timescale and resources available for the project. Instead we have conducted scoping reviews that allow identification of relevant literature and a rapid assessment of the evidence using the principles set out in the Rapid Evidence Assessment (REA) toolkit, available at: www.gsr.gov.uk/professional_guidance/rea_toolkit/what_is_an_rea/methods_for_reviewing_evidence/index.asp

A preliminary assessment of evidence has already been made by 'reviewing reviews' for the 999 EMS Research Forum prioritisation exercise. The reviews for this project have considered these evidence reviews and have also built on this assessment by conducting literature searches to identify any new evidence published since the prioritisation exercise work was carried out.

The Information Resources Group at the School of Health and Related Research (ScHARR), University of Sheffield, developed a template to guide the literature searches, which included:

- key evidence databases (see the Annex);
- alternative information sources to identify relevant 'grey literature'; and
- suggestions for key search terms to structure search strategies.

To ensure consistency in the evidence review process, structured guidelines were provided to reviewers. The principles for evidence review were as follows:

- The focus was pre-hospital care, which in the UK is the ambulance service but which internationally may be referred to as EMS and includes any provider of pre-hospital care, including doctor-based services such as those found in some European countries. Other parts of the emergency care system (A&E, primary care, MIUs, etc.) were not considered unless it was in the context of a relationship with ambulance service delivery, such as ambulance personnel referring patients to other parts of the system as part of their patient management.
- Research evidence was confined to the results of evaluative-type studies that have measured, for example, if something works and how well it works, have assessed impact on service delivery and patient care or have provided an understanding of why services operate or are used in a certain way (e.g. how patients choose to access services). Descriptive work (e.g. reports) that simply described changes or service delivery, with no measure of impact or effect of change or understanding of the processes, were not considered. Primary research that provided evidence of effectiveness, safety or understanding of a subject area was included, however.
- Because pre-hospital care has developed and changed significantly in the recent past, a cut-off of 15 years was set to retain context and applicability to present-day operations.

Definitions of the main subject areas were also supplied to provide focus for the reviews. These were as follows:

1. **Understanding the EMS organisation** – this refers to ambulance service/EMS workload and case-mix; evaluation of different models of service organisation, with an emphasis on what appears to work and what does not work in order to meet and manage demand for emergency ambulance services; the challenges that changing services can bring; and evaluation of strategies to overcome barriers and implement change.

2. **Understanding how services are being used** – the focus is patients and empirical evidence of differences in access, how patients choose to access services (particularly the 999 service) and any studies that may have been carried out where patients have been involved in planning services and where assessment has been made of success or otherwise of this strategy. Descriptions of why or how patients access services or arguments about whether or not they should be involved in planning (e.g. in policy documents) without any analysis or attempt to explain and understand the processes were not included.
3. **EMS workforce** – this is concerned primarily with ambulance personnel and their developing role in a changing emergency care system and the occupational hazards they face. This can be extended to include other groups such as doctors or volunteers but only where they provide an ambulance service (i.e. they work within the ambulance service or their deployment is managed by the ambulance service).
4. **Patient assessment and management** – the focus here is not on the assessment systems themselves but on processes to monitor safety and effectiveness which can identify risks, errors or duplication.
5. **Alternatives to ambulance response or transportation to A&E** – this refers to empirical evidence where alternative transportation protocols have been tested.
6. **Information and performance measurement** – this includes performance measures already in use (this can be broadened to look at what happens internationally) and empirical work describing development and testing, including efforts to link different data sources.

A total of 11 evidence reviews were conducted to assess the 18 agreed topic areas. Some items were considered in a single review; for example, all of the items within the topic area of alternatives to ambulance transportation were considered within a single review. All reviews were carried out by academic staff within ScHARR.

Assessment of evidence reviews

The final stage was a quality and relevance review of the 18 potential research topics. A simple scoring system was developed, taking into account each of the following three factors:

- quality of evidence and knowledge gap;
- research in progress; and
- policy relevance.

The scores are explained in Table 3.3.

Table 3.3 Scoring system for assessing research priorities

Score	Evidence	Research	Policy
2	Other evidence or no evidence – question unanswered.	No current related research identified.	Further research essential for policy development and implementation and/or to assess policy impact.
1	Class 2 evidence* or some gaps in understanding of topic area.	Related research in progress which may improve evidence but will not wholly answer the questions.	Further research would enhance policy development.
0	High-quality class 1 evidence** available – no gaps.	Research specific to the topic area already under way or no longer required.	Evidence of interest but not essential for policy development or implementation.

* Other empirical work, e.g. controlled observational, before-and-after cohort studies

** Systematic review or randomised controlled trial

The scoring system was applied to each of the 18 agreed topic areas and considered by the steering group. Adjustments were made following review of the summary conclusions of each evidence review and discussion of scores for policy relevance of each item and a final ranked table constructed. This is given in Table 3.4. For purpose of this document, reviews with total scores of 6 (highest research priority) have been colour-coded red; those with scores of 5 and 4 amber and yellow respectively; and those with scores of 3 (lowest research priority) green – see diagram on page 2.

Table 3.4 Ranked scores for 18 potential pre-hospital care research topics

	Evidence	Research	Policy	Total
Patient involvement in planning of emergency care (review 1)	2	2	2	6
Alternatives to ambulance response or transportation to A&E (review 2): Whole-system mapping	2	2	2	6
Patient priorities and decision making when using EMS and the effectiveness of publicity campaigns in influencing patient behaviour (review 3)	1	2	2	5
Managing change resulting from service re-organisation, service development and working across service boundaries in EMS (review 4)	1	2	2	5
What services and skills should be part of an EMS/pre-hospital care system that can manage high demand and varied case-mix, and understanding the range of skills and professionals needed to provide the pre-hospital care system (review 5)	1	2	2	5
Equality of access (review 11)	1	2	2	5
Alternatives to ambulance response or transportation to A&E (review 2):				
Asthma	2	2	1	5
Chronic conditions	2	2	1	5
Non-transportation and alternative destinations	1	1	2	4
Paediatrics	1	2	1	4
Mental health	1	2	1	4
Information and performance measurement (review 6)	1	1	2	4
Patient assessment and management:				
Near patient (review 7.2)	1	1	2	4
Non-transportation (review 2)	1	1	2	4
Epidemiology and understanding of demand for 999 ambulance services (review 8)	1	1	2	4

	Evidence	Research	Policy	Total *(Cont)*
Patient assessment and management (review 7.1): Control room assessment	0	1	2	3
Prevalence of PTSD in ambulance personnel and effectiveness of interventions (review 9)	1	2	0	3
Workforce safety and hazards when attending emergency calls (review 10)	1	2	0	3

The following key themes emerged from the evidence reviews:

- For some topics there was virtually no empirical evidence to inform service development. This was particularly true of topics concerned with patient involvement and with whole-systems approaches to designing pre-hospital care services.
- For other topics there was a substantial evidence base but it was limited to only certain condition types. For example, near patient assessment has been extensively researched for key conditions such as stroke, myocardial infarction and trauma; however, there is little evidence on assessment for less acute and chronic conditions. Similarly, alternatives to ambulance transportation to A&E have been examined in detail for some minor conditions but are less well researched for groups such as children and those with mental illness.
- Assessing the evidence for some topic areas was difficult as they were context-based. For example, attempting to identify evidence relating to the services and skills required for a 'good' pre-hospital care system depends on the type and scope of service to which a particular health service aspires and how this fits with other parts of the healthcare system.
- Issues concerned with safety, for example measuring the frequency of adverse events, have been confined to outcome measures as part of research studies. There is no evidence of routine monitoring as a measure of service quality.
- Although progress is being made to develop better performance measures for ambulance services, this is constrained by limited information. Patient outcome-based measures will require better information sources from elsewhere in the emergency care system.

References

1. Department of Health (2005). *Taking Healthcare to the Patient: Transforming NHS Ambulance Services*. London: Department of Health.
2. Snooks, H. (2008). *Promoting Research and Development in Pre-Hospital Care: Developing Research Strategy and Building Capacity*. Swansea: Centre for Health Information, Research and Evaluation (CHIRAL), Swansea University.
3. Department of Health (2008). *High Quality Care for All – NHS Next Stage Review Final Report*. London: The Stationery Office.

Annex: Template for researchers showing key reference sources and databases

Topic:		
Definition:		
Scope:		
Evidence:	**Database:**	**Results:**
Cochrane (www3.interscience.wiley.com/cgi-bin/mrwhome/106568753/HOME?CRETRY=1&SRETRY=0)	**Cochrane Systematic Reviews**	
	Cochrane Central Register of Controlled Trials	
National Institute for Health Research (NIHR)	**Health Technology Assessment (HTA) monographs** (www.hta.ac.uk/)	
	Service Delivery and Organisation (SDO) programme (www.sdo.nihr.ac.uk/)	
NHS Centre for Reviews and Dissemination (NHSCRD) (www.crd.york.ac.uk/crdweb/)	**Database of Abstracts of Reviews of Effects**	
	NHS Economic Evaluation Database	
	Health Technology Assessment Database	
Research in progress	**National Research Register** (https://portal.nihr.ac.uk/Pages/NRRArchiveSearch.aspx)	
	UK Clinical Research Network Portfolio Database (http://public.ukcm.org.uk/search/)	
MEDLINE (last five years) available through MUSE		
Health Management Information Consortium (HMIC) (http://gateway.ovid.com/): username and password available from ScHARR library		
Search using Google Custom Search Engine 'Intelligent Commissioning' (www.tinyurl.com/intellcom)		
Department of Health (www.dh.gov.uk)		
Other intelligence: search Google or other preferred search engine		