



Critical care paramedics

Delivering enhanced pre-hospital trauma and resuscitation care: a cost-effective approach



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The NHS Confederation
29 Bressenden Place London SW1E 5DD
Tel 020 7074 3200 Fax 0844 774 4319
Email enquiries@nhsconfed.org
www.nhsconfed.org

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Contents

Executive summary	2
Background	3
The study	5
Conclusion	10
References	13

Executive summary

A number of national reports have raised concerns about pre-hospital care for seriously ill and injured patients and recognised that more lives could be saved. South East Coast Ambulance Service NHS Trust (SECAmb) has responded to this challenge by developing 'critical care paramedics' (CCPs) with enhanced clinical capabilities. This report outlines the key findings and lessons from an evaluation of the CCP programme carried out by Dr Ashok Jashapara, senior lecturer in knowledge management at Royal Holloway, University of London. It looks at the achievements and challenges of this clinical innovation at SECAmb to treat high-risk patients.

Numerous national reports have acknowledged the need to improve the quality of hospital and pre-hospital care for high-risk patients and to reduce the 450-770 preventable deaths in England each year.

The US emergency medical system delivers 20 per cent lower mortality rates than the UK for trauma patients and is based on using paramedics rather than doctors in pre-hospital care; these systems sometimes include a 24/7 telemetric online 'virtual' medical presence at scene when required. This technology may have wider application in the UK.

The concept of operation used in this CCP study is based on the 'Anglo-American' model of ambulance service delivery, specifically the Melbourne, Australia variant which SECAmb is still developing towards, training paramedics

to CCP level in order to treat high-risk patients in the pre-hospital environment more effectively.

CCPs have developed a higher-level clinical knowledge base with an emphasis upon patient assessment together with some clinical skills relating to airways and cardiovascular management.

CCPs are currently being under-utilised in the critical care transfers role, and opportunities exist to work more closely with secondary care (hospital) providers to make this service more widely available.

International evidence is inconclusive as to whether doctors save more lives or achieve better clinical outcomes than paramedics operating at CCP level in pre-hospital care, but such medically-based systems, which substitute doctors in the paramedic role, are substantially more expensive to operate.

Cost-benefit analysis shows 'value of life saved' is £34,000 for paramedics operating as CCPs, compared to £252,000 for doctors providing the same provision in the field.

Medical input, while important to ambulance services, is likely to be most economically effective when focused upon 'high-level' clinical governance and education input, rather than duplicating what could be accomplished by paramedics at a much lower cost.

Background

A number of reports have been critical of sub-standard hospital and pre-hospital care for seriously ill and injured patients, and recognised that more lives could be saved. One common thread throughout these reports is the need to reduce between 450 and 770 preventable deaths in England each year and to improve patient survival rates, which are 20 per cent higher in the United States.^{1,2,3}

Higher patient survival rates in the United States occur in a paramedic-led system where organisational arrangements to bypass hospitals for trauma and other specialist centres are common. Medical input in these ambulance services focuses upon high-level leadership and management functions, such as clinical quality improvement, through audit, research, procedure development and the education and training of paramedics who deliver the care. The 24/7 availability of consultant-level advice to paramedics using telemetry avoids the need to place doctors in the field and subsequently avoids low levels of medical productivity. This system design is often referred to as the 'Anglo-American Model,' as opposed to the 'Franco-German Model' which substitutes doctors in the paramedic role.

The CCP system at SECAmb is based on the highly successful Mobile Intensive Care Paramedic (MICA) system in Melbourne, Australia. Launched in 1971 to tackle avoidable deaths of high-risk patients, the paramedics' advanced clinical skill set meant they were able to replace registrars on MICA ambulances. Successful pre-hospital systems of this kind are common in many Commonwealth countries, the United States, parts of the EU and in many military systems, even though they have been absent from the UK until recently. MICA paramedics have a broader scope of

clinical practice, including advanced airway management with endotracheal intubation and the use of a wide range of drugs, including those for drug assisted airways management, such as rapid sequence induction and intubation.^{4,5}

Many national reports have focused on improving the quality of trauma care. They suggest the need for greater quality assurance mechanisms to monitor standards of patient care and better clinical governance arrangements between pre-hospital and hospital care.⁶ They acknowledge that greater patient assessment skills, greater advanced airway management skills and the increased use of doctors may enhance the quality of care. Whether doctors are best suited for a clinical role in the field or whether paramedics, especially those with specialist training, can be equally effective is contentious.

Evidence from Germany's doctor-based emergency medical services (EMS) shows that their provisions are 42 per cent more expensive than in the UK.⁷ Doctor-based EMS does not necessarily lead to greater patient survival rates and can sometimes lead to higher mortality rates.⁸ The death of Princess Diana in Paris in 1997 is at the heart of this controversy. Some argue that she would have survived in a paramedic-based EMS in America compared to a doctor-based system in France.⁹ Lessons from the Purley and Cannon Street rail crashes in 1989 and 1991 suggested that paramedics could conduct many of the advanced capabilities currently in the domain of medical doctors.¹⁰

In order to tackle the issue of preventable deaths, the UK Government's strategy recently has been to develop trauma systems and networks. Trauma systems in the United

States, Canada, Australia and other countries have shown to reduce in-hospital mortality by 15 to 20 per cent, and there is every reason to believe the same can be accomplished in the UK.¹¹ Efforts are underway to improve trauma systems based on the recommendations of the NHS Clinical Advisory Group on Trauma.¹²

In its own analysis, SECAMB recognised the need for specialised paramedics to better manage the 600–700 cases of major trauma and to improve the survival rates of the 185 expected deaths each year. In addition, the CCP business case showed that there were 5,784 annual cases of high-risk but low-volume patients, over and above trauma patients, who could benefit from advanced CCP capabilities. Life-threatening calls represent 5 to 8 per cent of ambulance staff workloads, and the rationale was to develop highly-skilled CCPs

who would enhance their everyday learning from continuous exposure to seriously ill and injured patients.

It was recognised that the move to undergraduate preparation and the development of foundation and BSc degrees for all new paramedics would be valuable but would be only one part of a solution. It was assumed that greater familiarity with high-risk but low-volume patients would enhance the paramedic's learning curve and lead to better clinical outcomes. The rationale was to provide a small pool of highly-motivated, experienced paramedics with concentrated experience in high-risk patients and supported by regular coaching and clinical supervision. This is in contrast to traditional paramedics who may manage trauma patients very occasionally during their normal workloads.

The study

Approach

The aim of this study conducted by Dr Ashok Jashapara was to evaluate the introduction of CCPs at SECAmb, developed to meet the needs of high-risk patients, save more lives and treat a wider range of conditions, and to do so in the most cost-effective manner. The development of 'specialist practice' also helps ensure a clear professional development career pathway, which maximises the accrued clinical experience of paramedics and helps recruitment and retention within the paramedic profession.

A health economics and qualitative approach was adopted to determine the capabilities and cost effectiveness of CCPs. This included a comparison of the costs and likely clinical effectiveness of alternatively staffed models of enhanced pre-hospital care using paramedics and doctors. This study is based on an extensive analysis of the literature, 60 interviews with key stakeholders, observations of CCPs in the field, attendance at meetings including developmental activities, and a review of internal documentation.

Education, training and development of CCPs

Clinical innovation has occurred at SECAmb by closely modelling the development of CCPs to the MICA paramedics in Australia, although a number of other examples are in operation around the world. CCPs have developed with two distinct clinical skill sets – one for advanced primary retrieval activities and the other for critical care transfers.

The CCP curriculum was developed at the University of Hertfordshire in collaboration with Imperial College and was funded by the NHS challenge fund. The first CCP course started in

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September 2007. Training and development of CCPs comprised a taught component to develop an advanced knowledge base and a preceptorship component to expand their higher-level clinical skills in critical care. This role development is in line with the national allied health professions career framework and the College of Paramedics' (the professional body for paramedics and the ambulance professions) curriculum development framework.¹³

The majority of CCPs operate at level 6 (specialist paramedic), with some undergoing further development leading to level 7 (advanced paramedic) and ultimately the possibility of level 8 appointments (consultant paramedic) in the future. This approach mirrors developments in primary care where paramedic practitioners are following a similar pathway.

Plans exist for eight CCP 'ground' teams in the SECAmb region by 2013 and two further teams attached to the local helicopter emergency medical service (HEMS). Ground teams are currently based in Worthing, Brighton and Folkestone, and additional ground units will cover Crawley, Medway, Hastings and Paddock Wood with an unit planned in Chertsey during the first quarter of 2011/12. The SECAmb CCP teams cooperate with local clinical networks, emerging trauma centres and hospitals. The different uses of pre-hospital clinicians with critical patients are illustrated in Figure 1 on page 6.

Figure 1. The escalation of ambulance service resources and critical care paramedics to meet patient needs



* Medical support provided by telemedicine as per the United States, Canada and other countries.

CCP capabilities and clinical outcomes

Following their training and development programme, CCPs have reported a number of capabilities that have improved significantly when compared to their former roles as paramedics, including greater confidence in assessment and managing difficult airways. The wider clinical knowledge base provided by the training programme has also led to enhanced patient assessment skills for CCPs, improved diagnostic abilities and a broader knowledge of drugs beyond analgesia, although the administration of certain drugs, such as ketamine, is currently problematic in the UK in contrast to MICA paramedics in Australia and elsewhere.

Thinking 'outside the box' and looking at options and potential effects in critical situations has led to a greater ability to handle complex situations and, in particular, to foresee problems and understand alternative pathways when things go wrong. For some CCPs this has come naturally whereas others have felt a greater need for development of this role.

CCPs believe their newly found capabilities have improved their management of critical patients who often have multiple pathologies and complicated illnesses. It is a reasonable assumption that these advanced skills, reinforced by the steep learning curve from

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being tasked to handle complex calls, will lead to better clinical outcomes and increased patient survival rates, as has been achieved elsewhere.

Critical care transfers

Critical care transfers represent around 4 per cent of CCP workload. SECamb has followed the Australian model and aimed at developing a paramedic with high-level clinical skills in intensive care as well as advanced retrieval.

The intention was that CCPs would replace intensive care nurses as escorts, in some cases accompanied by doctors when required on transfers of critically ill patients between hospitals. This has not happened as frequently as initially envisaged. One adverse consequence of the low volume of transfers has been the risk of CCPs' transfer skills fading. They have not had the same workload as their Australian counterparts to reinforce their intensive care skills on a continual basis. Alternatives to the current situation would be to have an intensive care unit (ICU) nurse and CCP crew for critical care transfers, as found in the United States, or to have CCP/CCP crews with remote medical control, as found in Australia and in North America.

There is no clear financial incentive for hospitals to engage with transfers, even though it can relieve them of the need to have intensive care staff accompanying critically ill patients. In a climate of NHS staff shortages, especially in intensive care, this benefit has not been realised by hospitals, which is possibly due to insufficient communication. Greater collaboration between the ambulance trust, hospitals and critical care networks in the region would be beneficial in this regard. This has been recognised by SECamb, with the flu crisis in January 2011 providing the opportunity for them to support

East Kent Hospitals NHS Trust with the increased demand for critical care transfers, doing so by utilising CCPs to accompany the patient either with a doctor or on their own between acute settings. This is enabling ICU nurses to remain at intensive care units and for the CCPs to build on their critical care skills.

Tasking of CCPs

Appropriate tasking of CCPs has been an issue at SECAMB. As the yardstick of ambulance performance has focused upon response times, rather than clinical outcomes – a situation that will start to change nationally from April when new more clinically-focused patient outcome measures will be introduced – there has been an uneasy tension of emergency dispatch centres (EDCs) sending CCPs to calls based on geographic proximity rather than the high-risk nature of the call. This has been addressed by developing tasking guidelines for CCPs and having a dedicated dispatch desk for them. However, specialist dispatchers need to balance the patient's clinical need against ambulance services available and their travel times. Nevertheless, CCP units are seeing between two and four times more seriously ill and injured patients than other paramedic units.

Role of doctors and paramedics in pre-hospital care: a cost-benefit analysis

In any cost-benefit analysis of pre-hospital care the costs are relatively easy to ascertain, whereas the benefits are harder to discern. In the absence of CCP-related population-based studies examining improvements in patient survival rates, recourse to existing literature is the main source for exploring potential benefits.

There are a number of international studies that show increased survival rates from the use of specialist paramedics in pre-hospital care. From these studies, conservative assumptions of ground-based CCP interventions operating to their full potential and delivering their full scope of practice would lead to 4 to 5 per cent preventable deaths each year. Interventions by doctors would produce a 6 per cent improvement in patient survival rates.

CCP/doctor-staffed HEMS helicopters have a greater radius of action than ground units, across the South East Coast region during daylight hours, subject to aircraft availability and weather constraints. These assets need to be available for the most serious cases of major trauma to be effective in their role. Given these logistic assumptions, HEMS units are likely to reach 80 per cent of trauma patients during their daylight hours of operation and a small percentage of cardiac arrest patients.

Using these assumptions, a cost-benefit analysis was conducted (see Figure 2 on page 9). This showed that the cost of CCP teams in all eight PCTs is £272,475 and the 'value of life saved' is £34,059. The same provision provided by doctors would cost £3,030,412 and the 'value of life saved' £252,543.

The National Institute for Health and Clinical Excellence (NICE) adopts £30,000 as its threshold guidance for the introduction of a new drug. If one compared the 'value of life saved' on the introduction of CCPs in the UK (£34,059) to the threshold cost (£30,000) for a new drug, such an intervention would be seen as cost effective, albeit slightly exceeding the threshold. On the other hand, a doctor-based approach would be deemed too expensive, with a "value of life saved" of £252,543, while not necessarily being more effective according to the literature.

Figure 2. A cost-benefit analysis of using critical care paramedics and doctors at SECAmb

Strategic options	Potential lives saved	Improvement in preventable deaths	Total clinical cost at SECAmb per year	Value of life saved
Current CCP model (CCP teams in four PCTs)	4	2.2%	£136,237	£34,059
Developing CCP model (CCP teams in all eight PCTs)	8	4.3%	£272,475	£34,059
Fully developed CCP model (CCP teams in all eight PCTs with clinical and medical oversight)	10	5.4%	£471,703	£47,170
One doctor team 24/7 in the strategic health authority (two teams)	1.5	1.6%	£453,512	£302,341
One doctor team 24/7 in each PCT (eight teams)	12	6.5%	£3,030,412	£252,543

For instance, a meta-analysis of the literature¹⁴ showed that mortality rates were highest among doctor groups in pre-hospital care for trauma patients.

Evidence in the literature is mixed on whether doctors would be more effective at saving lives in the pre-hospital environment than CCPs. In addition, this debate does not consider the vital role of CCPs and doctors working in partnership. CCPs can provide the

primary retrieval provision in the field with consultant-level doctors providing enhanced medical supervision, online medical support via telemedicine, intermittent in-field coaching and supervision, generation of new procedures as well as research and audit functions. Similar to MICA paramedics, CCPs have the potential to possess the advanced capabilities of doctors in pre-hospital care given the right levels of ongoing clinical support and supervision.

Footnote

In respect to nomenclature there has been some confusing variation in the use of titles for paramedics operating in roles beyond the initial registration level. The Health Professions Council, the national regulator for all allied health professions, including paramedics, regulates registrants by their titles, which are protected in law, hence the use of 'critical care paramedic' or 'specialist paramedic' which are the terms used in this report. This position is also supported by the College of Paramedics (see College of Paramedics' Position Statement on the Designation of Paramedics and Extended Scope of Practice).

Conclusion

CCPs are one important thread in reducing mortality rates in the pre-hospital environment. International evidence shows they can make a difference and have an important contribution towards improving patient survival rates. SECAMB has provided the structure and clear focus for the introduction of CCPs, whose advanced clinical skills and capabilities can make a significant difference to trauma systems, as shown in Figure 3 on page 11.

The potential for integrating this new role with those of other healthcare professionals based in hospitals and emerging trauma centres is considerable. However, it is not only about using the most highly-skilled paramedics to treat the most seriously ill and injured patients, but about coordinating and delivering such high-risk patients to the best equipped hospitals or trauma centres in the region. This principle holds true for an increasing range of critical patient presentations, such as heart attack and stroke.

The developing clinical capabilities of CCPs means that they could have a wider role in supporting emergency preparedness via medical emergency response incident teams (MERIT), potentially in the form of paramedic medical emergency response incident teams (P-MERIT). Hazardous area response teams (HART), enhanced care teams (ECTs) and police firearms operations can also benefit from the addition of CCPs.

A real opportunity exists for NHS ambulance trusts to develop CCP schemes with negligible impact on their overall budgets. It is recognised that seriously ill and injured patients benefit from the application of certain well-understood principles and techniques. The role of the medical profession is critical in administering these schemes and ensuring that they reach

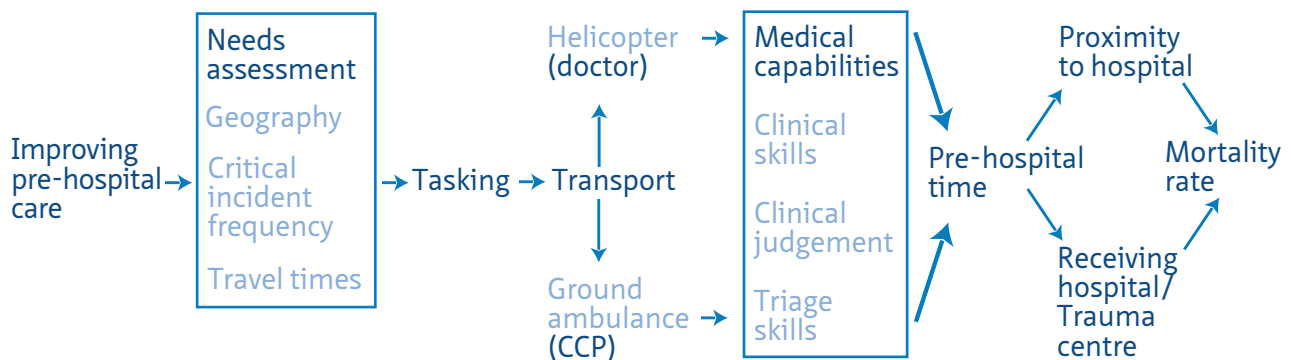
'A real opportunity exists for NHS ambulance trusts to develop CCP schemes with negligible impact on their overall budgets. It is recognised that seriously ill and injured patients benefit from the application of certain well-understood principles and techniques'

their full capability, but substituting medical labour in the paramedic role is difficult to justify. In practice, who actually delivers care 'on the ground' is less important, be they a doctor or a CCP, as shown in international evidence and best practice. The key issue thus becomes one of cost effectiveness. Doctors are considerably more expensive than CCPs. From existing evidence, the optimal solution would be to develop CCPs in the field, with doctors providing medical support and supervision, as has been proven to work successfully abroad.

To make a significant contribution to reducing mortality rates, these clinical and economic considerations need to be coupled with more effective organisational arrangements of trauma and critical care systems, incorporating the bypassing of certain hospitals, in order to take patients to the right trauma or specialist centre in good time. This can be achieved most cost effectively by releasing the full potential of the NHS ambulance service and implementing critical care paramedic schemes to serve the most seriously ill and injured patients.

For more information on this report or to respond to any of the issues raised, please contact Sangeeta Sooriah at sangeeta.sooriah@nhsconfed.org or Dr Ashok Jashapara at ashok.jashapara@rhul.ac.uk

Figure 3. Improving trauma systems through CCP capabilities



Summary of recommendations

Opportunities exist for NHS ambulance trusts to develop CCP schemes as part of efforts to improve standards of pre-hospital care and preventable deaths. However, future research is required to develop and optimise the design, operation and staffing of ambulance services and to further define clinical benefits.

Contributions to reducing mortality rates are likely to accrue when CCPs are integrated with specialist hospitals, trauma centres and trauma networks, coupled with the delivery of patients to the best equipped hospital or trauma centre in the region – organisational changes that need to accompany clinical innovation.

Paramedics with CCP education and training could have a wider role in:

- supporting emergency preparedness, potentially in the form of paramedic medical emergency response incident teams (P-MERIT)
- the crewing of helicopter air ambulance services
- the provision of proposed enhanced care teams (ECTs)
- the area of emergency preparedness and specialist operations such as the hazardous area response teams (HART), thereby reducing the cost of such provision.

In terms of future staffing of ambulance services, the optimal and most productive and cost-effective solution is likely to be developing paramedics at CCP level in the field, with doctors providing medical support (possibly using telemetry to provide a 'virtual' presence), clinical governance and advice as part of a multi-professional team approach.



SDO Network

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Dr Ashok Jashapara's work with SECamb was supported via the ESRC/SDO Network fellowship scheme. The placement fellowship approach has ensured that the research meets the needs of SECamb, as well as maximising the transfer of knowledge within and beyond the organisation.

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If you are an NHS organisation interested in hosting an academic placement fellowship, please contact Tom Barker at the SDO Network: tom.barker@nhsconfed.org. If you are an academic interested in placement opportunities, contact Lesley Lilley at the ESRC: lesley.lilley@esrc.ac.uk

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The author



Dr Ashok Jashapara is an internationally recognised expert in knowledge management and published widely in books and journals. He has secured research funding and successfully completed research projects for the ESRC, NIHR SDO, EU and the United Nations. He was associate director for the information studies discipline with the Higher Education Academy and external examiner for various masters programmes at Sheffield University. He is also trustee of the Joseph Rowntree Foundation.

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NHS CONFEDERATION



The NHS Confederation
29 Bressenden Place London SW1E 5DD
Tel 020 7074 3200 Fax 0844 774 4319
Email enquiries@nhsconfed.org
www.nhsconfed.org

