

# ABC<sub>of</sub> Prehospital Emergency Medicine

Edited by Tim Nutbeam and Matthew Boylan



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ABC<sub>of</sub>

# Prehospital Emergency Medicine

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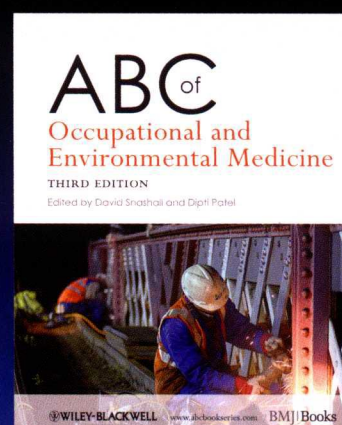
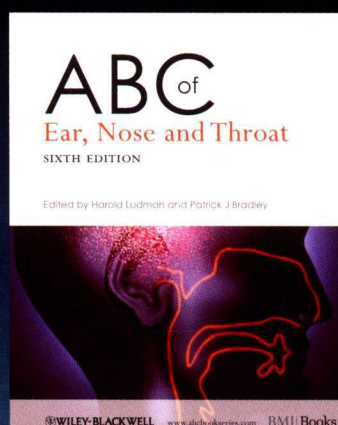
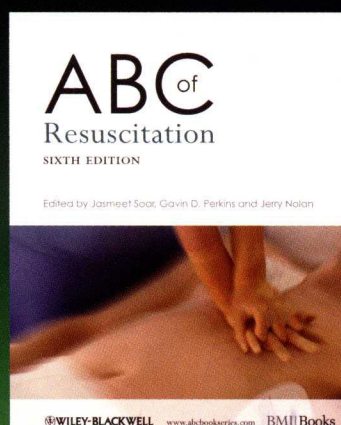
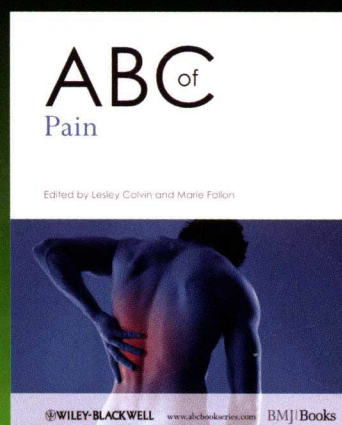
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# Foreword

Until recently, training in advanced prehospital care relied on seeking out experts and hassling them for snippets of wisdom, and applying for a post on one of the few existing helicopter emergency medical services. No single written resource was available for study, and the preparation for the Diploma in Immediate Medical Care required assimilation of several disparate texts.

Recent years have seen the modernization and some standardization of practice, an explosion of services able to provide prehospital critical care, and the hard won recognition of the subspecialty of Prehospital Emergency Medicine (PHEM), with dedicated training schemes for PHEM practitioners. The need is greater than ever to collate an overview of recommended practice into a single publication.

This book covers a comprehensive spectrum of prehospital topics written by the 'hard-hitters' in the field: specialists at the forefront

of civilian and military practice. It will guide PHEM trainees, help in postgraduate immediate care exam preparation, and assist any prehospital provider wanting an update in the current state of the art.

This is the book I wanted as a trainee but never had. I am thrilled at its publication, and am heartened that I now have the pleasure of recommending it to my own trainees.

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# Preface

The *ABC of Prehospital Emergency Medicine* began life in 2009 as a collaborative project in response to joint frustrations over the lack of a concise, single resource capable of delivering the essential knowledge and key practical techniques required for effective Prehospital Emergency Medicine (PHEM) practice.

We began the project with two clear aims:

- to present accessible, cutting edge, expert opinion on core PHEM topics
- to provide the reader with the practical knowledge and resources to put this knowledge into clinical practice.

Throughout our own training and ongoing practice in PHEM we have been inspired and informed by a number of experienced prehospital practitioners both in the UK and abroad. We are grateful that many of these individuals have agreed to share their knowledge and experience more widely by contributing to this text. Our expert authors represent the wide range of healthcare practitioners to which we hope this text is both accessible and useful.

Over the last 4 years the project has been forced to evolve and grow in response to exciting developments in clinical care and prehospital governance. The most welcome of these has been the formal recognition of PHEM as a subspecialty within the UK and the development of a comprehensive PHEM curriculum. It is our hope that this text will serve as a useful educational tool for PHEM trainees, as well as a useful revision aid for the seasoned prehospital practitioner.

We must thank the team at Wiley Blackwell, our supportive (and tolerant) families and our expert team of authors without all of whom this project would never have happened. Finally we would like to dedicate this text to the hundreds of prehospital practitioners who have dedicated many hundreds of thousands of hours of their own time to make the speciality what it is today.

Tim Nutbeam  
Matthew Boylan

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## CHAPTER 1

# Prehospital Emergency Medicine

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## Introduction

'Prehospital care' is the term given to the provision of medical care outside of the hospital or alternative fixed healthcare setting. In the developed world, the provision of prehospital care is usually the responsibility of a regional ambulance or emergency medical service (EMS). A number of agencies may operate in support of the ambulance service including private ambulance companies, rescue organizations (e.g. mountain rescue, air ambulance services), the voluntary aid societies (e.g. Red Cross) and immediate care practitioners (e.g. British Association of Immediate Medical Care, BASICS).

## Prehospital emergency medicine

Prehospital emergency medicine (PHEM) is a field within prehospital care (Figure 1.1). PHEM's evolution has been triggered by the demand to meet new challenges imposed by the regionalization of specialist medical and trauma services. Many of the critically injured or unwell patients that prove to benefit most from these new systems of care are paradoxically those less likely to tolerate extended transfer without advanced critical care support. As a result, there is a need to provide a body of prehospital practitioners capable of providing advanced clinical assessment and critical care intervention at the scene of an incident, together with safe critical care retrieval to an appropriate centre of care. In most continents the enhanced skill set required to provide this level of care falls outside that deliverable by the ambulance service or its supporting bodies, and therefore requires the deployment of specially trained physician-led teams.

The role of the PHEM practitioner or team is to augment the existing prehospital response, not replace it. Their function is to provide an additional level of support for those patients with higher acuity illness and injury, both on scene and during transfer. In doing so they are also well placed to educate and enhance the skills of the prehospital providers they work alongside.

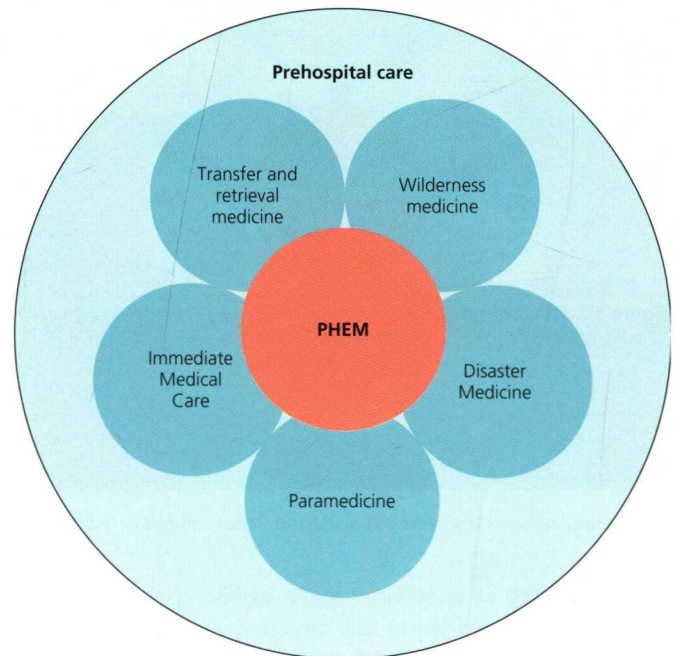


Figure 1.1 Prehospital emergency medicine.

## Training in PHEM

An important move forward in the evolution of the field of PHEM in the UK has been its recognition as a new medical subspecialty led by the Intercollegiate Board for Training in prehospital Emergency Medicine (IBTPHEM). IBTPHEM has produced a curriculum that outlines the knowledge, technical skills and non-technical (behavioural) skills required to provide safe prehospital critical care and safe transfer. Links to the IBTPHEM and their curriculum can be found in the further reading section. The key themes of the curriculum are shown in Figure 1.2.

Similar prehospital training programmes exist across Europe (e.g. Germany) where they are firmly integrated into medical training and the emergency medical services (EMS). In Australasia, geography has been the driving force behind the development of retrieval medicine as a specialization. A number of retrieval services (e.g. Greater Sydney Area HEMS) have recognized the commonality between PHEM and retrieval medicine and have



**Figure 1.2** Prehospital emergency medicine curriculum themes (Courtesy of IBTPHEM).

moved towards delivering a combined model that provides both interfacility secondary transfer and primary prehospital retrieval. The experiences of many of these systems has helped mould the new PHEM subspecialty within the UK.

## Summary

PHEM is a challenging and exciting development within the area of prehospital care. This book aims to provide some of the underpinning knowledge required for effective PHEM practice.

## Further reading

IBTPHEM website: [www.ibtpphem.org.uk](http://www.ibtpphem.org.uk).

## CHAPTER 2

# Activation and Deployment

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### OVERVIEW

By the end of this chapter you should:

- Understand how emergency calls are handled and prioritized
- Understand the different types of dispatch
- Understand the risks and benefits of deployment by road
- Understand the risks and benefits of deployment by air.

### Introduction

The first step in delivering high-quality prehospital care is the timely activation and deployment of prehospital resources. The initial aim is to get the right resource to the right patient in the right time frame. This process requires efficient call handling, robust call prioritization and intelligent tasking of resources. Prehospital practitioners may deploy to scene using a variety of different transport modalities. The choice of modality will be determined by the system in which they work and by the nature and location of the incident.

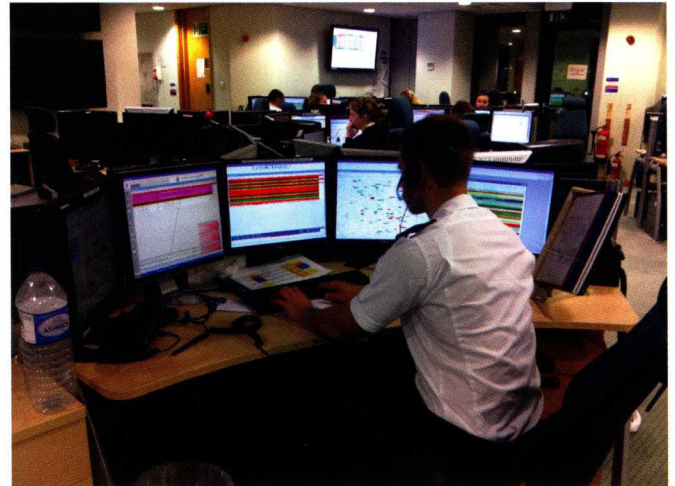
### Activation of prehospital services

It is important for the prehospital practitioner to have an understanding of how emergency calls are processed and resources dispatched.

### Call handling

In most developed countries there is a single emergency telephone number that members of the public may dial to contact the emergency services. The emergency number differs from country to country but is typically a three-digit number that can be easily remembered and dialled quickly, e.g. 911 in the USA, 999 in the UK and 000 in Australia. In the 1990s the European Union added 112 as the Global System for Mobile Communications (GSM)-approved common emergency telephone number.

Emergency calls from telephone and mobile phones pass to operators within designated Operator Assistance Centres (OACs)



**Figure 2.1** Computer-aided dispatch in the emergency control centre.

run by phone providers. Their function is to determine which emergency service is required and forward the caller details to the appropriate Police, Fire or Ambulance Emergency Control Centre (ECC). In the UK this information is passed electronically in the form of Caller Line Identification (CLI) via a system called Enhanced Information Service for Emergency Calls (EISEC). The data then appears automatically as an incident on the dispatchers computer-aided dispatch (CAD) screen in the ECC (Figure 2.1). While this automatic data transfer occurs, the caller is connected to a call taker at the ECC who will begin the process of call prioritization.

### Call prioritization

There are a number of systems by which calls can be prioritized. The most common system used within the UK ambulance service is the Advanced Medical Priority Despatch System (AMPDS). Similar systems of Medical Priority Dispatch are in use within the USA and Australia. AMPDS uses a structured question-answer logic tree to allocate a dispatch priority: **Red – Category A** (immediately life threatening), **Amber – Category B** (urgent call), or **Green – Category C** (routine call). This mode of caller interrogation is known as systematized caller interrogation. AMPDS incorporates protocolized pre-arrival first aid instructions that are relayed by the call taker to the caller while they await the emergency response.

In addition, each injury and injury mechanism is allocated a unique AMPDS code for audit purposes.

Although effective in prioritizing an ambulance service response, AMPDS has been shown to lack the sensitivity and specificity required to select calls that would benefit from enhanced prehospital emergency medicine (PHEM) intervention. In order to identify these cases, an additional tier of enhanced caller interrogation and dispatch criterion is required. For maximum efficiency this tier should be delivered by active PHEM practitioners (e.g. critical care paramedics or doctors) as they are in the best position to make accurate judgements about the likely need for advanced interventions. The use of non-clinical dispatchers in this role is associated with high rates of over-triage.

The model operated by London Helicopter Emergency Medical Service (HEMS) in the UK represents current best practice for enhanced call prioritization and dispatch. A dedicated HEMS dispatch desk within the Ambulance Control Centre is manned by an operational HEMS paramedic. They are responsible for scanning all the incoming cases and identifying those that would benefit from enhanced intervention. A set of evidence-based criteria known to be associated with severe injury are used to trigger the 'immediate dispatch' of the helicopter or car-based team (Box 2.1). Certain other cases undergo direct caller interrogation by the paramedic to assess whether enhanced intervention would be beneficial (Box 2.2). This is termed 'delayed dispatch'. The clinical knowledge and experience of the HEMS paramedic is critical in ensuring rapid and accurate identification and prioritization of these cases. The third form of dispatch is the crew request, which is treated as an immediate dispatch.

## Dispatch

While the call is being prioritized by the call taker, the dispatcher is responsible for allocating an appropriate resource(s) to the incident. Most modern CAD systems have an integral automatic vehicle location system (AVLS) which will automatically populate a list of the nearest available resources. The choice of resource will depend on the location, mechanism of injury, number of patients involved and the perceived severity of injury. Most ambulance services have now moved from VHF radio to digital data transmission (e.g. Airwave in the UK) as their primary mode of communication. Incident details are sent directly to vehicle-mounted data terminals with integrated satellite navigation systems that will automatically plot the route to the incident. Alternative modes of dispatch include activation via a base telephone landline, mobile phone or pager system. The activation and dispatch process is summarized in Figure 2.2.

## Deployment of prehospital services

The ambulance service may deploy its resources to the scene of an incident in a number of different ways: foot, bicycle, motorbike, car, ambulance, helicopter or fixed wing aircraft. The decision to deploy a particular asset will be determined by the distance the asset is from the incident, the accessibility by road, known congestion and the required skill set of the responders. PHEM practitioners deployed to augment the ambulance service response will usually deploy by land vehicle or by helicopter.

### Box 2.1 Immediate dispatch criteria (London HEMS)

Fall from greater than 2 floors (>20 feet)  
'One under' (fall or jumped in front of a train)  
Ejected from vehicle  
Death of a same vehicle occupant  
Amputation above wrist or ankle  
Trapped under vehicle (not motorcycle)  
Request from any other emergency service.

### Box 2.2 Incident categories for interrogation (London HEMS)

Shooting  
Stabbing  
Explosions  
Road traffic collisions  
Industrial accidents/incidents  
Hanging  
Drowning  
Entrapments  
Amputations  
Burns/scalds  
Building site accidents  
Falls from height less than two floors  
Impalement

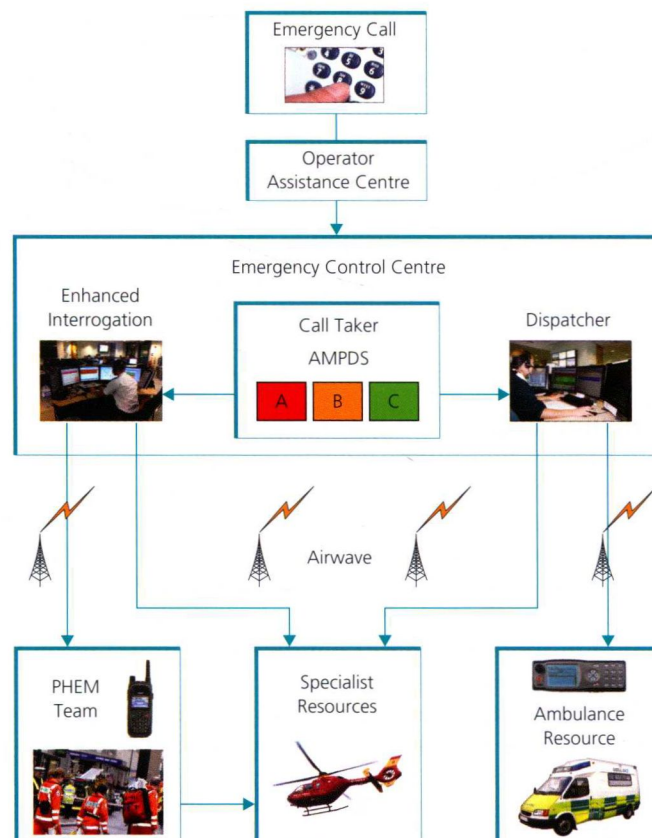


Figure 2.2 Overview of activation and dispatch process.



Figure 2.3 Physician response vehicle (Courtesy of Ivan Barefield).

### Deployment by land vehicle

Many systems deploy their prehospital practitioners by rapid response vehicle (Figure 2.3). Land-based deployment is not restricted by weather or daylight hours in the same way that helicopter deployment is. They are ideal for operations in built-up urban areas as they are not limited by the need for an appropriate-sized landing site. Over short distances they also offer similar response times to helicopters because of the additional time taken by helicopters for take-off and landing.

Response vehicles must be roadworthy. A daily vehicle check is important and should include fuel and oil levels, water coolant, screen wash, electrics, lights and tyres (tread depth, inflation and damage). Medical equipment should be appropriately restrained and a lockable box available for CD storage. The vehicle should have visual and audible warning devices, as well as high-visibility markings. Drivers must be appropriately trained and insured for emergency response driving.

Activation may be via radio or mobile phone. If activation occurs while the vehicle is mobile, the driver should pull over at the next safe opportunity before further details of the incident are taken. Appropriate personal protective equipment should be donned at this point. Progression to scene should be made rapidly but safely with the full use of visible and audible warning devices. Parking at scene will usually be under the direction of the police. If the prehospital practitioner is first on scene at a road traffic accident, the fend-off position may be used to protect the incident scene (Figure 2.4). The vehicle should be positioned approximately 50 meters back from the incident and positioned to afford maximum use of rear visual devices and reflective high-visibility markings. The front wheels should be turned in a safe direction to reduce the risk of the vehicle being pushed into the incident if another vehicle collides with it. Keys should be left in the ignition and the engine left running to prevent the battery draining flat. Once parked in a fend-off position, no one should return to the vehicle unless absolutely necessary.

### Deployment by helicopter

In remote and rural areas, helicopters increase both the range and speed of PHEM team deployment and allow a single team



Figure 2.4 Fire tenders protecting the scene in the 'fend-off' position (Courtesy of Shane Casey).



Figure 2.5 Urban HEMS (Midlands Air Ambulance).

to cover a large geographical area. Helicopters have also shown proven benefit in the urban setting where congestion may limit rapid deployment by road (Figure 2.5). Their use may be restricted by poor weather conditions, onset of darkness or the lack of an appropriate landing site.

Helicopter operations within Europe are regulated by the Joint Aviation Regulations Operations Specifications (JAR-OPS). Similar national regulations are in place in the USA and Australasia. JAR-OPS define a HEMS flight as a flight to facilitate emergency medical assistance, where immediate and rapid transportation is essential, by carrying either:

- medical personnel
- medical supplies (equipment, blood, organs, and drugs)
- ill or injured persons and other persons directly involved.

The HEMS designation is important as it carries with it alleviation from normal weather limits and exemption from certain Rules of