# Introductory teaching for intensive care residents: development and implications

***Within intensive care medicine there is a need to rapidly and safely integrate junior doctors into individual units with effective introductory training. Evolution of such training is influenced by pressures placed on clinicians to maintain standards of care.***

## Introduction

Reductions in working hours for junior doctors have increased demands on training (Stagnaro-Green, 2004; Agarwal and Darzi, 2006; Reznick and MacRae, 2006). This arguably began in the UK with 'Calmanisation' (Calman, 1993). Training curricula have been developed to make training time more effective (Royal College of Anaesthetists, 2007; Intercollegiate Board for Training in Intensive Care, 2007); however, implementation of the 'New Deal' and European Working Time Directive (EWTD) has further affected this (NHS Management Executive, 1991; European Commission, 2003). Other influences include technological changes in intensive care medicine and increasing numbers of doctors with no previous experience of intensive care medicine requiring training (Royal College of Physicians, 2002; Vohra, 2002; Kellet et al, 2004).

The authors' institution has moved from a resident rota of anaesthetists (year 2 senior house officers (SHOs) to year 3 specialist registrar) to SHOs with no previous intensive care medicine experience working in an integrated unit, consisting of level 2 and 3 beds (Department of Health, 2000). A curriculum for new trainees was therefore developed in order to allow them to function effectively as critical care resident doctors. The course was developed via consensus discussion among senior medical staff on the intensive care unit and used guidance on training curricula (Harden, 1986; Davis and Harden, 2003). This article outlines the development process.

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Planning included a 'Wiseman' approach, a study of errors and current best evidence (Harden, 1986; Davis and Harden, 2003). The Wiseman approach involved analysis of other introductory courses (European Society of Intensive Care Medicine, 2007; Society of Critical Care Medicine, 2007; University of Hong Kong, 2007). This, plus an examination of errors in practice, guidance from the Clinical Negligence Scheme for Trusts and training curricula (European Society of Intensive Care Medicine, 2007; Royal College of Anaesthetists, 2007) initiated course development. Questions asked during development included (Harden, 1986; Davis and Harden, 2003):

1. Needs and requirements (generic and specific) of the trainees? Aims of an introductory curriculum?
2. Can the previous experience and background knowledge of the trainees be used, e.g. providing a study guide that acts as a prompt for work performed in undergraduate physiology teaching?
3. Should teaching be clinical or classroom based?
4. Materials and technologies available and/or relevant?
5. Who should teach?
6. How should the teaching be delivered?
7. How can the teaching be evaluated?

These points are addressed in turn below. Since the introduction of the course (*Table 1*) the following has been performed:

1. Quality assurance via trainee evaluation
2. Consideration of future developments, e.g. Modernising Medical Careers (MMC).

## Needs and requirements of trainees

Specifics depend on experience and are outlined when the Intercollegiate Board Tutor negotiates an educational contract with the trainee. Generic needs relate to both the unit itself and postgraduate development per se. General Medical Council (GMC) guidance encompassing professionalism and lifelong learning (General Medical Council, 2006) should also be emphasized.

Doctors new to intensive care medicine must learn to understand and operate essential equipment, e.g. ventilators. They also require knowledge of the pathophysiology of organ dysfunction, plus relevant pharmacology. Education for capability is necessary, in keeping with effective risk management.

## Previous experience and background knowledge

In the authors' institution approximately two-thirds of trainees are new to the spe-

**Table 1. Core topics**

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|---|
| The pathophysiology of hypoxaemia and critical illness |
| Acute lung injury, acute respiratory distress syndrome and ventilation strategies |
| Ventilators and infusion pumps |
| Shock and inotropes |
| Sepsis |
| Invasive cardiovascular monitoring |
| Acute renal failure |
| Major vascular surgery |
| Liver failure |
| Sedation, analgesia and muscle relaxants |
| Microbiology and critical care |
| Upper gastrointestinal haemorrhage |
| Nutrition in critical illness |
| End-of-life care |

cialty. They tend to be classified as 'novice learners' or 'advanced beginners' (Dreyfuss and Dreyfuss, 1986). In this case novice indicates a trainee with no experience of the situations in which he/she is expected to work, who will acquire knowledge and skills through instruction. An advanced beginner has faced some clinical situations, acquiring a basic competence in dealing with problems presented to them. A small number of trainees have experience, creating situational awareness, i.e. 'knowledge' and 'competence' (Dreyfuss and Dreyfuss, 1986).

All trainees confirm that they have previously received undergraduate physiology teaching. Application of the knowledge is uncertain, however, i.e. students 'know' but do not 'understand' (Mierson, 1998). Thus introductory training has to begin with defining critical illness, analysing pathophysiological processes and developing an understanding of how the critically ill are supported. To assist, a study guide is provided (*Figure 1*).

## Classroom *vs* clinical teaching

With respect to the novice there are disadvantages in an entirely clinical setting that relate to levels of knowledge, decision-making processes and organizational pressures (Lyon, 2004; Jones and Morris, 2006). Thus while 'bed-side' teaching and experiential learning are necessary, a didactic approach away from direct patient contact may improve learning (Lim et al, 2005).

***Figure 1. Study guide examples.***

**Critical illness**

- Regardless of the precipitating factor critical illness is an imbalance between oxygen demand, oxygen supply and oxygen utilization
- A disruption of the process of oxygen utilization at any point from oxygen source (air or piped supply) to mitochondria can create this imbalance
- A failure or inability to stop this disruption can rapidly lead to several points of disruption in the oxygen cascade with a patient's condition rapidly spiralling out of control
- Managing critical illness and its pathophysiology therefore requires knowledge of the physiology and biochemistry of oxygen delivery and oxygen utilization at cellular level

**Shock and inotropes**

The definition of shock will be explored in relation to the physiological consequences to the body. The various common presentations of types of shock (hypovolaemic, septic, cardiogenic, anaphylactic, obstructive, neurogenic/vagal) will be presented in terms of their clinical effects and resulting physiological derangements. The treatment options will be compared and contrasted as will the current mortality rates. The classification of inotropes based on their properties at various receptor sites will be presented. The physiological basis and logic of their use in the shock scenario will be considered and the contrasting effects and possible toxicity of actions discussed

**Sepsis**

- Systemic inflammatory response syndrome and sepsis definitions
- Severe sepsis/sepsis syndrome and septic shock
- Immediate ventilatory and circulatory support
- Ongoing ventilatory and circulatory support
- Identify source (e.g. cultures) and treat infection:
  - Immediate appropriate broad spectrum antibiotics
  - Source control, e.g. surgery, radiology, catheter removal
  - Pathogen identification and specific antimicrobial therapy
- Infection control
- Surviving Sepsis campaign

**End of life care on the critical care unit: a framework**

- Intensive care mortality approximately 18–22%, and inhospital mortality approximately 27–32%
- Intensive care models require palliative as well as 'diagnostic or curative' model
- Suggested framework includes:
  - Diagnosing futility and end of life
  - Achieving consensus around concepts of futility
  - Guidance for effective palliative care
  - Defining the role of the critical care team
  - Providing effective support
  - Awareness of potential controversies

Trainees' basic background knowledge may be limited or hidden, e.g. previously learnt physiology may not have immediate clinical relevance. Thus attempting bedside teaching can create pressures, e.g. trainees may be overwhelmed by the environment paying little heed to the basics of, for example, respiratory, cardiovascular or renal physiology. With an appropriately planned curriculum, a classroom setting can minimize 'crowdedness', provide a supportive environment away from clinical pressures and allow for step-wise or analytical problem solving (Cleave-Hogg and Benedict, 1997).

The clinical setting can also create pressures for the trainer. Organizing clinical and logistical tasks can limit availability for the effective teaching of a novice or advanced beginner. Consultants can manage sudden clinical problems effectively and rapidly because they have well-developed naturalistic decision making. In such circumstances management steps taken by the trainer are not necessarily obvious (or explicable) to a new trainee (Lipshitz et al, 2001). At best learning opportunities may be lost if background knowledge has not been provided in context and at worst the trainee fails to gain confidence, again becoming overwhelmed.

Therefore, while the clinical context is necessary, provision of background knowledge in a classroom is advantageous to the novice or advanced beginner. It can provide a solid learning base, putting previous educational experiences into context and providing opportunities to problem solve and develop decision-making skills.

## Teaching materials and appropriate application

This is a debate of low (e.g. basic writing/visual materials) *vs* high technology (i.e. varying degrees of information technology and simulators) or how such resources can be best combined. Simplicity (and possible trivialization) must be balanced against complex technology and possible confusion.

The most frequently used media are flip charts and computer-based presentations. There is a familiarity and availability that fits well into the local environment. Resource and organizational issues limit the use of more advanced technologies, e.g. simulators. The provision of a study

guide with key references (emailed) further uses information technology creating the opportunity for trainee initiative to further enhance learning.

## Who should present the teaching?

The main trainers should be senior medical staff from the unit. However, the commitment required has to be considered in relation to consultant job planning and appropriately allocated supporting professional activity. There is a therefore a need (and opportunity) to involve others. Specialists in other areas such as hepatology, microbiology and medical ethics are invaluable and senior trainees (as part of their own training requirements) need to be involved. Coordination and responsibility rests with the Intercollegiate Board Tutor and (secondarily) with the departmental rota-maker.

## How should the teaching be delivered?

Teaching takes the format of lectures or small group teaching. Initial sessions (often slide presentations) were strongly didactic and provided trainers with templates for presenting relevant information in an appropriate time span. With increased experience, sessions have become more interactive and problem-based. Regardless of approach a basic format is necessary, i.e. gaining attention, setting objectives, stimulating prerequisite learning and presenting appropriate stimulus material that enhances retention (Donnelly and McDaniel, 1993).

Gaining attention and citing objectives centres on the relevance of the topic, such as using a recent patient (and their management) as an example of a certain condition, e.g. acute lung injury. Emphasizing trainees' existing skills and 'inherent intelligence' as functioning, responsible, professional adults (General Medical Council, 2006) can be useful and minimize negative experiences associated with hierarchical environments that may exist. Retrieving hidden background knowledge can occur by getting trainees to 'cast their minds back' and quizzing or 'brainstorming' can build understanding around such 'factual knowledge'. Understanding can be further advanced via analogous imagery (Donnelly and McDaniel, 1993; Cosgrove et al, 2006).

## How was the teaching evaluated?

Self-evaluation, trainee evaluation and external peer review contribute to course evaluation and have included visits from the Royal College of Anaesthetists, the Intercollegiate Board for Training in Intensive Care Medicine and the local university. Such roles will be assumed by the Postgraduate Medical Education and Training Board. Effective evaluation will require knowledge of current trends in curriculum planning, e.g. education for capability, promoting professionalism, and problem-based learning (Harden, 1986; Davis and Harden, 2003). Processes of feedback include educational contracts, designated educational supervisors, informal review, appraisal and documented feedback of the course (*Figure 2*). The approach allows for future planning, keeping effective educational sections and reviewing or revising less effective sections.

## Introductory training in intensive care medicine and the future

Ongoing changes in medical training precipitated the development of this course. With MMC the need for such courses could expand. Patient safety is paramount; clinical governance and the recommendations of *Good Medical Practice* (General Medical Council, 2006) must therefore underpin such programmes. Another consideration is shift-work impinging on attendance. One potential way forward is to condense core topics into a series of days at the start of an attachment, possibly involving 'cross-Trust' cooperation.

With ongoing training time being at a premium with EWTD patterns, trainees should assume an increased responsibility for their own learning, i.e. a significant self-directed element should exist. One potential medium is web-based learning, used within our region at the James Cook University Hospital, Middlesbrough and currently under consideration for ongoing intensive care medicine training within the Northern Deanery of the Northern and Yorkshire Region (Dr D Murray and Dr S Bonner, James Cook University Hospital, personal communication, March 2006, January 2007). Such a system may also assist the added challenge of keeping up to date with the rapid evolution of the technology and evidence base of the specialty.

## Conclusions

Introductory training is essential for effective risk management and professional development. Curricula can be developed from consideration of what information is required, what is the background (training and knowledge) of those being trained and what facilities are available to deliver the teaching? Consultant enthusiasm (assisted by national bodies) can drive the processes; however, the pressures on delivery of health care within the UK may make ongoing development difficult. BJHM

***Figure 2. Critical care introductory teaching evaluation sheet.***

Dear trainee
Please complete the evaluation below. Its intention is to apply collectively to the teaching programme, but if you wish to add any comments about specific topics please feel free to do so. You can put your name to these or leave them anonymous.

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| Topic | Good | Satisfactory | Poor |
|---|---|---|---|
| Environment | | | |
| Relevance of topics | | | |
| Clarity of teaching | | | |
| Organization and timing | | | |
| Enthusiasm of trainers | | | |

General comments:

Thank you for your comments. They will be most useful in the organization of further courses.

*Conflict of interest: Dr Laws, Dr Nesbitt, Dr Cressey and Dr Kilne have no conflict of interest. Dr Cosgrove is a member of the Regional Standards and Training Committee for Intensive Care Medicine which has recently discussed the introduction of a region-wide introductory course.*


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## KEY POINTS

- Employment legislation altering working patterns for junior doctors is creating changes in the organization of postgraduate medical training.
- In the UK increasing numbers of junior doctors are working in intensive care medicine without any prior experience of the specialty.
- Introductory training is necessary for 'novice' and 'advanced beginner' trainees.
- Such introductory training must encompass key topics relevant to the basics of critical illness per se and the local working environment.

# Education and training

**The education and training section of the *British Journal of Hospital Medicine* is unique, as it is aimed at all working doctors who are involved in teaching doctors and other health-care professionals, not just those who specialize in medical education.**

**We welcome submissions for this section on educational initiatives and developments in hospital medicine from trainers and trainees.**

**If you have a suggestion that you would like to discuss in more detail, please contact the editor, Rebecca Linssen, on bjhm@markallengroup.com or telephone 020 7501 6718. Articles should be submitted online at http://www.epress.ac.uk/bjhm/webforms/author.php**