Integrating education, training and assessment: competency-based intensive care medicine training

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Abstract · This review aims at providing a concise educational background for the development and implementation of competency-based ICU training. It describes the theory underpinning competency-based training in general, and subsequently considers specific issues of its implementation for intensive medicine training.

Keywords · Workplace based assessment, intensive care, training, assessment, guidelines, competency, competence

Introduction

Over the last century medical education has evolved from discipline-based medical curricula, via those based on specific themes, to problem-based integrated curricula. More recently there has been a progression towards defining curricula in terms of educational outcomes through competency-based training, particularly at graduate and specialist residency level [1-5], in attempts to “assist future specialists in responding to the innumerable challenges as health care providers while providing the best specialty care”[4]. All major organisational bodies, including the Accreditation Council for Graduate Medical Education (ACGME) in the USA [6], the General Medical Council in the UK [7], and the Royal College of Physicians and Surgeons in Canada [4], have developed such competency frameworks. The Central College for Training of Medical Specialists (CCMS) in the Netherlands adopted the latter Canadian Medical Education Directions for Specialists (CanMEDS) competencies in 2005 [5]. Since significant differences exist between specialties, the specialty-specific tailoring of the general competency framework is relegated to specialty-specific committees. In the UK, a comprehensive competency-based training programme for intensive care medicine (ICM) was developed in 2001 [8]. In 2006 the CoBaTrICE programme published competencies for an international training programme in ICM using more than 5000 suggestions by over 500 respondents worldwide [9]. This programme has now been adopted by eight European Union (EU) member states, with four more in the process of adoption. Although the competency-based approach has thus been widely introduced, adopted and adapted, many trainees and trainers are uncertain about the specific implications of implementing competency-based training [10]. In this review the authors will therefore examine the theory underpinning competency-based training, and then consider the specific issues of implementation for ICM training.

The theory behind competence and performance

Almost 15 years ago Paul Hager and Andrew Gonczi noted that different dictionaries define competence or competency as the “ability to do” something, the “ability for a task”, “the quality of being competent”, where competent means “properly qualified” or “capable” [11]. They concluded that “the prime focus is on competent people having the ability or capability which will enable the satisfactory completion of some (in the context of realistic professional) task(s)” [11]. In the contemporary medical education literature a further distinction between competence and performance is made [12]. Competence most often relates to what people can do in staged settings to demonstrate the best of their ability, whereas performance relates to what people actually do on a day-to-day basis in the workplace [13]. Most frequently, a description of the abilities or capabilities required for competent performance of an occupation typically invokes terminology using the classic triad ‘knowledge’, ‘skills’ and ‘attitudes’. Thus in the conception of competence, general and vocational education are intertwined. Although this approach is relatively novel, it is by no means a complete solution to the problem of defining the best approach to vocational training. Like every other educational method, competency-based education is subject to limitations, drawbacks and criticism, and its successful introduction requires a systems-wide approach [7,14].

In order to assess competence it has to be inferred from performance, because it cannot be directly observed in daily practice [11]. In order to define competence in measurable outcomes, the practice of a doctor’s work is often fragmented into a myriad of separate tasks [10]. Daily practice however is obviously much richer than simple sequences of such isolated
(though interdependent) tasks. A (re-)synthesis of the tasks, thereby reconstructing a certain degree of holism MUST be warranted (a holistic approach to competence is paramount) [11]. This synthesis must take context into account to ensure that the clinical environment – the workplace – can provide appropriate opportunities for observation of practice.

Although competency-based training permits diversity and flexibility in performing educational tasks while standardising desired outcomes, observation and objective assessment of competence presents challenges for many trainers. Educational goals and objectives or outcomes must be monitored and measured to track progress and identify potential areas of improvement and remediation. However, given the complexity of clinical work, the assessment of competence is not simply a matter of ticking checklist boxes for observed behaviours. The assessments should adequately reflect all the component elements of the competencies as defined for different specialities. Therefore, assessment should be performed frequently, sample over many different contexts, touch upon many different performances (relating to different competencies), and use different assessment instruments by different (trained) assessors. Workplace based in-training assessment is thus yet another central element of competency-based medical training programmes [15]. Whereas in the past “equal weight was given to both process and outcome of learning, progress in a competency-based training programme is defined by the competencies achieved (as evidenced by the assessments; outcome-oriented training), and less determined by the underlying process or time served in the programme (process-oriented education)” [10]. Furthermore, individualised, flexible training has now become more than a merely theoretical option. Although flexibility is a thus prominent feature of the competency-based training approach, some common standard for clinical competence needs to be defined. For the specialty ICM, the CoBaTrICE (Competency- Based Training in Intensive Care Medicine in Europe) collaboration coordinates this process.

From theory to practice: intensive care medicine and CoBaTrICE

CoBaTrICE is an international collaboration managed by the European Society of Intensive Care Medicine’s division of Professional Development, and endorsed by the European Board of Intensive Care Medicine and the national training organisations of 28 European countries. CoBaTrICE uses survey and consensus techniques, combined with expert opinion and external consultation, to develop the component parts of an internationally acceptable competency-based training programme for intensive care medicine for Europe and collaborates on this subject with representatives from other world regions [16,18]. The aim of this initiative was to ensure a common standard for clinical competence in the ICU. The core knowledge, skills, attitudes and associated abilities (competencies) resulting from a training programme would be similar for all physicians although trained in different countries, thereby facilitating free movement of medical professionals and mutual recognition of medical qualifications between member states. In contrast to this ambition, a recent survey of the training environment for ICM in Europe undertaken by the CoBaTrICE collaboration [18], found that so far half of member states had no formal system for assessing and documenting competence in ICM by the end of specialist training [17]. In our experience, considerable uncertainty about the practical consequences of competency-based ICM training and assessment often exists. Themes emerging from a recent CoBaTrICE collaboration publication identified a need for more information on contemporary best educational practice, practical guidance regarding the most frequently used WPBA instruments, and the guidelines for constructing or improving ICM training assessment programmes [15]. These themes seem to relate closely to the four step approach to construction of competency-based training programmes previously described by Leung; first, determine the appropriate competencies, then, devise a training programme, next, devise an assessment programme, and finally, set minimum pass standards [10]. These steps are consecutively discussed in the following sections.

Defining core competencies for intensive care medicine

The competency-Based Training program in Intensive Care in Europe (CoBaTrICE) used a modified online Delphi technique combined with an eight-country postal survey of patients and relatives, and an expert group [19]. The initial surveys generated over 5,250 suggestions for competencies from 57 countries. Ultimately, these combined processes resulted in 102 competency statements aggregated into 12 domains (listed in Table 1). More extensive descriptors and statements regarding the different competencies are provided on the website [www.cobatrice.org] and in the original publication9. A training and assessment programme for intensive care training can

### Table 1. Competency domains for intensive care medicine as determined by the Competency-Based Training program in Intensive Care in Europe (CoBaTrICE) [19].

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<tr>
<th>NO.</th>
<th>DOMAIN NAME</th>
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<tbody>
<tr>
<td>1.</td>
<td>Resuscitation and initial management of the acutely ill patient</td>
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<tr>
<td>2.</td>
<td>Diagnosis: assessment, investigation, monitoring, and data interpretation</td>
</tr>
<tr>
<td>3.</td>
<td>Disease management</td>
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<tr>
<td>4.</td>
<td>Therapeutic interventions/organ system support in single or multiple organ failure</td>
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<td>5.</td>
<td>Practical procedures</td>
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<tr>
<td>6.</td>
<td>Peri-operative care</td>
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<td>7.</td>
<td>Comfort and recovery</td>
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<tr>
<td>8.</td>
<td>End-of-life care</td>
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<td>9.</td>
<td>Paediatric care</td>
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<td>10.</td>
<td>Transport</td>
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<tr>
<td>11.</td>
<td>Patient safety and systems management</td>
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<tr>
<td>12.</td>
<td>Professionalism</td>
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subsequently be constructed based on these 12 competencies. Comparison of these ICM core competencies to the CanMEDS framework reveals that most of the non-medical competencies are herein represented under ‘professionalism’ and that the medical domain is described in more detail. Further development of the programme will be a dynamic and evolutionary process taking into account the evolving roles of the intensivist and advances in medical education. We discuss these issues in the following sections.

Devising an intensive care training programme

The evolving roles of the intensivist

An increasing emphasis on the generic, non-specific medical competencies is a contemporary phenomenon observed in both medical undergraduate and postgraduate education [20-29]. Likewise, the emphasis on professionalism in the CoBaTrICE survey was considerable, equalling technical ability [19]. Teamwork, judgment, and attitudes, behaviours, and communication skills were herein mentioned as examples of professionalism [19]. Since this emphasis of other aspects of learning apart from knowledge is a hallmark of competency-based training, the next section will discuss several of these aspects in more detail, and describe the trainees’ view in this regard.

Teamwork, leadership and communication

Apart from the individual competences of trainees in ICM, their capabilities to work as part of a team deserve increasing attention. Collaboration between critical care specialists, other hospital specialists, nurse practitioners, physician assistants, critical care nurses, dieticians, and other health care workers, is a hallmark of contemporary ICM. Reader et al. recently reviewed the literature findings on intensive care unit team performance [30]. The ICU team’s output (measured in patient outcomes, for example, adverse event and mortality) and team outcomes (for example, job satisfaction) is influenced by group processes related to team communication, leadership, coordination and decision making.

Table 2. Necessary steps regarding the implementation and organisation of a feasible and acceptable teaching and assessment system

<table>
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<tr>
<th>NO.</th>
<th>NECESSARY STEPS REGARDING THE IMPLEMENTATION AND ORGANISATION OF A FEASIBLE AND ACCEPTABLE TEACHING AND ASSESSMENT SYSTEM</th>
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<tbody>
<tr>
<td>1.</td>
<td>Form a task force on workplace based assessment.</td>
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<td>2.</td>
<td>Appoint a responsible chair, a lead person to lead the assessment system. Preferably, this person should have sufficient hierarchical authority to ensure quality assurance and control of the training and assessment programme.</td>
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<td>3.</td>
<td>Perform analysis of the existing teaching and assessment programme. Strengthen aspects of the programme that are well-functioning, and discard only those aspects that are considered insufficient.</td>
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<td>4.</td>
<td>Seek external, educational expertise regarding teaching and assessment if deemed necessary.</td>
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<td>5.</td>
<td>Select assessment instruments from the available pool of methods. Since reliability and validity are more dependent on the use of the instrument than the instrument itself, already existing externally validated forms can be used, if necessary with local adaptations. Ample space for feedback and documentation should however be preserved.</td>
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<td>6.</td>
<td>Consider organisational requirements and restraints. Sufficient and effective administrative and secretarial support will allow staff members to focus effectively on educational, assessment and patient care related activities.</td>
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<td>7.</td>
<td>Integrate teaching and assessment by emphasizing the developmental aspect of training (formative, feedback), without ignoring the potential consequences for progressing into subsequent phases of training (summative, pass or fail decisions).</td>
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<td>8.</td>
<td>Create awareness regarding the importance of workplace based training and assessment by instituting mandatory staff development programmes, including instruction of administrative support personal, and trainees. Make sure that clarity is provided regarding the supervisors’ and trainees’ responsibilities. Since assessment of the expertise of staff is essential, and this does not come naturally for all, teach-the-teacher sessions regarding assessment are pivotal.</td>
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<td>9.</td>
<td>Assessment should be preferably built into the daily intensivists’ routine practice, so that disruption of patient care is minimal. Acceptable and feasible assessments are short and simple (e.g. observing provision of information to relatives after admission of a patient). Using many short observations by different observers rather than a few long ones by only a few observers is likewise more practical and acceptable, and increases reliability and validity of the assessment at the same time.</td>
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<td>10.</td>
<td>After the initial implementation, a careful re-evaluation should be performed, and necessary adjustments made accordingly.</td>
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<td>11.</td>
<td>Training and assessment in units with suboptimal standards of clinical practice will likewise be suboptimal; a supportive learning environment with adequate role models should be created to make our actions congruent with our rhetoric. Leadership is obviously important in this regard. Input from trainees (a view from the trenches) should be sought.</td>
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<td>12.</td>
<td>In case of persistent poor performance by a trainee, a clear remediation plan should be individually tailored to the trainee’s needs, with regular information exchange between all those involved. Practical aspects are having clear objectives before scheduled meetings, scribing, and setting transparent goals and expectations. Any progress reported and agreements made, should be tested against the original plan of action. A time-frame in which these should be fulfilled, and assuring adequate guidance and frequent performance feedback sessions are also of paramount importance. If progress is not in line with the agreements, this must have negative consequences for the trainee, in the worse case scenario resulting in mandatory cessation of training.</td>
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making [30]. The team processes are likewise dependent on the input, influenced by group hierarchical structures and member characteristics, number and diversity of tasks and time pressure, and, leadership [30]. Good ICU team leadership (including defining goals, organising team resources and coordinating team activities) improves patient safety [30]. Team communication (relating to transfer of ideas, information, opinions) has also been shown to be linked to safety and performance, with errors being concentrated after moments of communication (for example, handovers, or physician-nurse communication) [30]. Until recently, little was known with regard to the trainees’ view on the generic aspects of learning. Two recent studies examined elements of professionalism as perceived relevant for intensivists from the ICU trainees’ view, and the way these are taught and/or learned in the intensive care unit [9,31]. These are discussed in the next paragraph.

A view from the trenches
Consistent with the review by Reader et al. [30], communication and teamwork were considered most relevant for intensivists in the first study by van Mook et al. [20]. Residents thus seem to develop their perception of the meaning of professionalism from the context in which they work [32]. The second study revealed that the trainees prioritised communication, keeping a professional distance and setting boundaries, medical knowledge and expertise, and respect, teamwork, leadership, organisation, and management as aspects of professionalism. Contrary to the authors’ expectations, the trainees did not perceive medical knowledge and technical skills as the key aspects of intensivists’ professional behaviour [19]. The results from these two studies underscore the relevance of more ‘generic’, not specifically medical, competencies, such as professionalism for ICM training [20,31]. Although professionalism was perceived to be mainly absorbed and learned ‘on the job’ from role models [31], formal courses and sessions on professionalism were nevertheless also valued. Self-reflection, for example stimulated through structured feedback, and assessment, was emphasized as a starting point for learning around professionalism. In this regard, the importance of a motivated and stimulating supervisor is pivotal [31]. These novel insights into the previously unknown needs of ICM fellows regarding training in these domains may now be used to remediate the currently limited attention to them in their training programme.

Implications of some recent advances in medical education
Learning occurs faster and leads to better retention of the subject matter studied when it takes place within a relevant and realistic context. The ICU is an arena ‘par excellence’, eminently suited for the purpose of learning and assessment on-the-job [9]. Nevertheless, another robust finding in the literature indicates that a well-organised knowledge database is a pre-requisite for successful problem solving [33]. Consequently, knowledge-oriented teaching and assessment should not be neglected when constructing an ICM programme.

Table 3. Overview of the most commonly used workplace based assessment

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<th>NO.</th>
<th>METHOD*</th>
<th>WHAT IS IT, AND HOW TO USE IT?</th>
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<tr>
<td>1.</td>
<td>Mini-Clinical Evaluation Exercise (mini-CEX)</td>
<td>The mini-CEX is used to rate performance through direct observation of a clinical encounter using a form on which there is list of criteria and room for written feedback leading to specific learning goals. Observations and feedback sessions can be kept brief. The form is not standardised; adaptations to make it fit local needs are allowed, but some experience and training in the use of the instrument is recommended. In general 7 – 10 independent observations suffice. For professionalism, the only validated tool available is the professionalism mini-evaluation mini-exercise (P-MEX) [52]</td>
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<td>2.</td>
<td>360-degree/ multi-source feedback</td>
<td>Multi-source feedback accesses the opinions of multiple observers from different backgrounds on specific aspects of the individual being assessed, using a simple rating scale. The assesseee often first completes the questionnaire him/herself to aid reflective learning in comparison with the forms returned from (usually 10-12) assessors, who may include peers, supervisors, paramedical staff, nurses, administrative staff and patients or relatives. The results are collated before they are fed back to the assesseee (e.g. in an appraisal session).</td>
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<td>3.</td>
<td>Portfolio</td>
<td>A portfolio can be seen as analogous to a clinical case record, documenting symptoms, investigations, working diagnoses, progress over time, and outcomes. Careful implementation is crucial, and good mentoring regarding portfolio development is the single most decisive success factor. It must be smart and lean, to prevent it from becoming unmanageable. The best approach in the specialty training setting is a dossier of evidence for competence acquisition (e.g. mini-CEX forms, multi-source feedback, results of knowledge and knowledge application assessment, with reflective learning, informal observations and deliberations).</td>
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* Extensive information on these and other tools can be found on www.cобавrite.org and in publications by the Academy of Medical Royal Colleges [53] and The Postgraduate Medical and Training Board [54].
Secondly, deliberate practice leads to higher levels of expertise than unstructured practice [34]. In workplace based training (and assessment) this would mean observing the trainees regularly, providing them with immediate feedback in conjunction with concrete suggestions on how to improve, and as well as providing the trainee with opportunities to improve. Finally, the outcome should be re-assessed.

Thirdly, the feedback given should meet generally accepted feedback criteria. Feedback should be aimed at observed behaviour, be provided immediately after the observation, be concrete, contain positive as well as negative aspects of the observed behaviour, and should be accompanied by concrete learning goals and plans for follow-up [35,36]. Obviously, teachers must be trained in providing feedback, whereas trainees should actively solicit its provision. A safe learning environment is extremely important in this regard. In a hostile, overly competitive environment observation-based learning (and assessment) will not work.

**Devise an assessment programme**

Assessment has a strong impact on how and when students learn: assessment drives learning [12]. Assessment is therefore a fundamental component of a quality intensive care training programme. The content of the assessment, as well as its format and scheduling are the most influential factors in this regard. More longitudinal or continuous assessment - shorter, regular assessments - leads to more continuous learning behaviour. Assessment tools should preferably meet the criteria of validity, reliability, feasibility (of which cost is an important element) and acceptability (to all stakeholders) [37-40]. In daily practice a compromise between these utility criteria is inevitable [40].

The ‘utility’ or usefulness of an instrument is a function of the relationship between several elements, and will vary according to the context and purpose of the assessment. The next section consecutively addresses the criteria for assessment.

**Reliability**

Since individual performance is influenced by the context in which the doctor works, observations may vary from situation to situation. In general a combination (‘triangulation’) of various instruments is necessary to assess performance over a wide range of competencies and contexts [41,42], since there is a positive relationship between the size of the ‘sample’ and the reliability of the assessment decision. One single observation is never reliable enough for high-stakes decisions, neither are multiple observations done by only one supervisor. Any assessment tool will provide information about more than one competency and a competency can only be assessed comprehensively by using different methods [43].

**Validity**

With some assessment instruments, e.g. multiple-choice tests, it does not matter who, for example, scores the answers. Reliability and validity (the extent to which the test actually measures what it is purported to measure), are built in. However, in observation-based assessment the instrument is reasonably unimportant, whereas the assessor is essential. From a reliability perspective subjectivity is not a problem, as long as the sampling is wide enough, and the assessor has access to some standards or criteria on which to judge performance. Training the trainers is thus of pivotal importance.

**Acceptability and feasibility**

Although workplace based assessment can be integrated with routine clinical care, some forms of assessment can be time-consuming (and thus expensive) for intensivists in an already busy ICU. Observations and feedback sessions do not need to be lengthy, and the responsibility for assessment should be dispersed over many different team members, including nurses and other professionals. In our and others’ experience, nurses and physician assistants can excellently judge communication skills, compassion, and team working ability [44,45], and capture a more complete account of trainee’s competency [45].

Summarizing the preceding sections, several steps regarding implementation and organisation of a feasible and acceptable teaching and assessment system need to be addressed to make the newly developed programme successful in practice [46]. These are summarized in Table 2. Best evidence is herein combined with the authors’ personal experiences and opinions.

The most commonly used methods available for workplace based assessment are summarized in Table 3. IT systems and e-portfolios could provide a clear link between competencies and assessment processes, a trainees’ development over time and across different training environments [47].

**Set minimum standards (and strive for excellence)**

As stated by Leung, ‘Leading Royal Colleges set criterion referenced minimum pass standards by a panel agreeing on the probable scores of borderline candidates’ [10,48]. Focus is thus currently on the minimum acceptable standards. One of the most frequently voiced concerns in this regard is the potential risk of encouraging minimum standards [49-51], or ‘promoting deskilling’ instead of encouraging professional excellence. Hager and Gonczi consider such claims rather dubious [11]. The existence of a minimum level of performance (and thus competence) implies the existence of a whole range of different performances from excellent to fail [11]. A minimum safe standard is thus where professional training starts, not where it ends [50]. Recently, Dutch intensive care fellows acknowledged the abovementioned: In a recent study striving for excellence was identified as one of the key factors pertaining to the professionalism of intensivists [20]. The anticipated potential problem of settling for anything less than the best by setting minimum standards, is thus not perceived by intensivists-in-training.
Conclusions
The competency-based approach has picked up momentum over recent decades, and has stimulated beneficial changes in many postgraduate clinical training programmes. Competency-based programmes have a strong focus on outcomes and recognize and emphasize the relevance of the workplace with respect to both learning and assessment. The outcomes are explicitly expressed as observable workplace performances, thereby facilitating their assessment. Although many programs have embraced the concept, the incorporation of the competencies and its implementation has often proved cumbersome, since guidelines regarding implementation are often non-specific and/or lacking. In a joint European initiative, the CoBaTrICE project recently coordinated the major task of identifying the ICM competencies, as well as identifying guidelines on the implementation and organisation of a successful training and assessment programme for ICM training. A structured and efficient approach with adequate resourcing of education, training for trainers, and engagement of all staff in education and assessment is mandatory in order to make such training programmes an educational success, and deliver high quality clinical care at the same time.

Abbreviations
EU European Union
CoBaTrICE Competency-based training in Intensive Care medicine in Europe
ICM Intensive Care Medicine
WPBA Workplace based assessment

References