Review Article

A competency-based approach to critical care education

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Abstract

The medical education environment is rapidly changing. Competency-based medical education (CBME) is a great advance, but operationalizing competencies for teaching and assessment is problematic. Entrustable professional activities (EPAs) can revitalize CBME by connecting competencies to practice, creating flexibility in programs. CBME requires and deepens the nature of workplace-based assessments. It is important to use EPAs to verify residents' ability to care for critically ill patients unsupervised in simulation education.

Keywords: *Competency-based medical education, Entrustable professional activities, Simulation*

Introduction

Competency-based medical education (CBME) is a 21st-century revolution in medical education that has become a mainstream means of training modern physicians. It is composed of six core competencies established by the Accreditation Council for Graduate Medical Education (ACGME) [1]. The key concept of CBME is to design courses based on the core abilities required by trainees and to emphasize the results of training, rather than assessment of the training process [2]. It is an outcome-based approach for the design, implementation, assessment, and evaluation of a medical education program using an organizing framework of competencies [3,4]. The currently promoted CBME overemphasizes the concept that the medical profession is composed of many professional competency fragments [5]. At present, higher level medical expertise cannot be demonstrated and evaluated using CBME [6].

The concept of entrustable professional activities (EPAs) was first proposed by Ten Cate. EPAs can be defined as professional responsibilities that can be fully entrusted to a trainee [7,8]. Clarifying the relationship between two important concepts – competencies and EPAs – is important. EPAs are not an alternative to competencies but a means to translate competencies into clinical practice. EPAs usually facilitate a holistic and integrated assessment of clinical tasks. Achieving an EPA often requires multiple core competencies. The difficulty, risk, or complexity of EPAs can be increased based on the ability of trainees. Therefore, medical educators can apply a series of EPAs and supervise the competency level that trainees need to achieve [9]. EPAs can be executed, and the process and results can be observed separately or simultaneously depending on the competency level of trainees. Determining whether the trainee possesses the "trusted" core ability is appropriate [10]. The concept of EPAs has been gradually implemented in different areas of medical professional education, such as family medicine [11] and pharmacology [12]. The Association of American Medical Colleges has also developed 13 core EPAs that medical students should be able to perform on entering residency [13].

How to transition to practice

A review of the literature has clearly shown that abundant information on EPAs in clinical teaching is available. Kman *et al.* proposed an EPA test for clerkship through simulation of a diagnosis of a myocardial infarction with ST-segment elevation with cardiac arrest [14]. Approximately 86% of students reached the judgment of entrustment at the end of the test. Students rated the experience as valuable and thought that it would change their performance in a clinical setting. Thompson *et al.* developed a critical case scenario assessment instrument through high-fidelity simulations to evaluate medical students' performance in executing critical actions related to EPA-13 competencies [15]. In their study, 87% of participants were rated as having reached entrustment to manage the care of an emergency patient. In these two studies, a team comprising at least four students jointly managed a case scenario. However, only the team leader was evaluated using the assessment instruments. Critical actions included assigning triage skills, mustering the medical team, identifying causes of patient illness, and initiating management. Identifying backup solutions

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is an essential trait for medical students. The high-fidelity simulation showed favorable potential for the effective assessment of medical students' ability to manage an urgent or emergency patient [15].

Entrustable professional activities in teaching programs and critical care education

Conventional health-care education involves didactic instruction using lectures and clinical learning through the apprenticeship method. However, a systematic and integrated teaching approach is lacking. Experiential learning represents an advance in health-care education; it is defined as learning from clinical practice exercises when caring for patients [16]. However, this is difficult in the modern medical environment because of safety and privacy concerns. Inexperienced doctors may not appropriately manage critical medical emergencies, which may be harmful to patients, resulting in training physicians experiencing psychological stress and feeling burdened [17].

Medical simulation training is one of the most important innovative teaching models in medical education of recent years. It can provide a training environment that does not affect patient safety and privacy and can tolerate erroneous judgments and incorrect technical operations [18]. A simulation can be repeated to show a general or rare complex critical situation; it can also be applied in an almost realistic environment. The simulation can be suspended at any time for an *ad hoc* discussion or repeat demonstration. After the simulation is completed, participants can provide feedback on the training process and review cooperation among peers; this can increase learning among participants [19].

The current fellowship training program in pulmonary and critical care medicine already integrates EPAs and curricular milestones. After receiving training, fellowship graduates are expected to be able to perform unsupervised. These EPAs and curricular milestones have been decided by a multidisciplinary committee of medical educators representing the American College of Chest Physicians, American Thoracic Society, Society of Critical Care Medicine, and Association of Pulmonary and Critical Care Medicine Program Directors [20]. Moreover, it has been suggested that bronchoscopy training programs should incorporate multiple tools, including simulation, and that certifying agencies should transition from a volume-based certification system to skill acquisition and knowledge-based competency assessment for trainees [21]. According to the performance of individuals, we can provide different levels of assessment consistent with EPAs to vary degrees of training and achieve different levels of assessment.

A sufficient competency training program for patient care includes counseling, discharging patients, leading family meetings, designing treatment plans, and resuscitating patients. To take care of critically ill patients in intensive care units, it is important to maintain and improve their vital signs and hemodynamic status, including monitoring and treatment of cardiopulmonary function, to understand the pathophysiology

of major stress, such as shock or trauma, to correct imbalances in nutrition, electrolytes, coagulation, and metabolism, to form a differential diagnosis, to give appropriate therapy, and to consult other specialists properly to work together to treat patients. EPAs are the focus of assessment by observation, ratings, or other means. The overall assessment of competencies is not actually done; instead, it is inferred from the assessment of sufficient EPAs [22]. Reaching this level takes fixed standards and flexible time.

Before implementing simulation education with entrustable professional activities

To design EPAs, a practitioner is usually required to integrate multiple competencies from several domains, such as content expertise and skills in collaboration, communication, and management [23]. Designing a high-fidelity simulation for a critical medical condition, coupled with actual operational procedures, enhances the clinical skills of team members and strengthens teamwork cooperation and communication skills [24]. Simulations must be consistent with the skill level and cognitive ability of the trainees to facilitate their learning in a safe environment; before scenario simulation, teachers should engage in planning, developing achievement goals, implementing methods, consensus building, summarizing, and giving key tips [25]. Balancing thoughtful challenges for learners and adequate supervision is necessary. The instructor can directly assess the abilities of team members, including their medical knowledge, communication skills, professionalism, clinical judgment, treatment, operational procedures, and teamwork [26].

Simulation is a comprehensive teaching strategy that can be performed through real clinical practice exercises. A plan or goal should be established when using the simulation to teach trainees [27]. For example, after assessing the needs of students, the theme of the case scenario should be carefully selected and implemented, and the cost-effectiveness of training should be measured with the subject group of teachers [28]. EPAs can serve as a roadmap and destination for trainees, program directors, and educators. Together with reporting milestones, EPAs can indicate trainees' progress in the mastery of the six ACGME core competencies of graduate medical education [Table 1] [10,29].

What entrustable professional activities add to competency-based evaluation

Much of the work in health care entails tasks or responsibilities that must be entrusted to individuals. Research has demonstrated that ability, integrity, and reliability must be fulfilled for someone to trust another person and be willing to be vulnerable to the risks associated with doing so [9]. An entrusted trainee must demonstrate the necessary competence to execute EPAs unsupervised. Ten Cate proposed a five-level rating scale. At Level 1, the trainee is ready to be present and observe; at Level 3, the trainee is ready to act under indirect supervision; and at Level 5, the trainee is ready to provide supervision to junior learners [10]. Each of the five levels has direct consequences for the trainee and for patient care. During the training program, multiple EPAs are designed to mimic

critical conditions such as septic shock, acute respiratory failure, and acute coronary syndrome [Table 2] [29-31]. EPAs even mimic advanced cardiovascular life support to verify residents' ability to care for patients with other team members. Finally, at the end of the training program, all residents are expected to be able to independently care for critical medical patients unsupervised.

VALUE OF ENTRUSTABLE PROFESSIONAL ACTIVITIES IN CRITICAL CARE EDUCATION

The medical environment is changing rapidly and medical disputes are increasing. Most patients have a sense of hostility toward inexperienced physicians. The trial-and-error approach cannot be used to teach trainees how to manage critical illness because of safety concerns. Simulation can provide learning opportunities and facilitate repeat demonstration of similar scenarios in the absence of stress in the environment. It is important to use EPAs to verify residents' ability to care for critically ill patients unsupervised in a simulation scenario [32]. Simulation scenarios should be integrated to connect competencies to enhance critical care education.

Table 1: Examples of entrustable professional activities related to their most important Accreditation Council for Graduate Medical Education competency domains

Illustrative EPAs	ACGME competencies					
	MK	PC	ISC	P	PBLI	SBP
Performing an appendectomy	■	■				
Designing a therapy protocol	■				■	
Chairing a multidisciplinary meeting		■	■	■		■
Requesting organ donation			■	■		
Chronic disease management	■	■	■			■

■Competence activities. EPAs: Entrustable professional activities, ACGME: Accreditation Council for Graduate Medical Education, MK: Medical knowledge, PC: Patient care, ISC: Interpersonal skills and communication, P: Professionalism, PBLI: Practice-based learning and improvement, SBP: Systems-based practice

Table 2: Examples of entrustable professional activities and related Accreditation Council for Graduate Medical Education competencies in a critical care training program

Illustrative EPAs	ACGME competencies					
	MK	PC	ISC	P	PBLI	SBP
Mechanical ventilator setting in acute respiratory failure	■	■		■		
Executing a patient handover	■	■	■	■		■
ACLS: Ventricular tachycardia management	■	■	■	■	■	
Septic shock management	■	■	■	■	■	
Acute coronary syndrome management	■	■	■	■	■	■
Family conference: Telling the bad news			■	■		■

■Competence activities. EPAs: Entrustable professional activities, ACGME: Accreditation Council for Graduate Medical Education, MK: Medical knowledge, PC: Patient care, ISC: Interpersonal skills and communication, P: Professionalism, PBLI: Practice-based learning and improvement, SBP: Systems-based practice, ACLS: Advanced cardiac life support

CBME is a great advance, but operationalizing competencies for teaching and assessment is problematic [33]. EPAs can revitalize CBME by connecting competencies to practice and can create flexibility in programs required by CBME, ensuring the comprehensiveness of workplace-based assessments.

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Conflicts of interest

There are no conflicts of interest.

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