

## How do we turn surgical residents into safe intensive care unit clinicians? An Entrustable Professional Activities guided framework

Editor

The Coronavirus Disease 2019 (COVID-19) pandemic has resulted in unprecedented public health, social and economic impact<sup>1</sup>. The sudden influx of critically ill patients

has strained hospital capacities across the world and the shortfall in the number of critical care beds available has required institutions to actively expand intensive care unit (ICU) services. The concomitant postponement of regular hospital operations including non-critical elective surgeries has led to the rapid mobilization of surgical residents to staff COVID-19 ICUs without appro-

priate opportunity for time-based training or knowledge-based examination to ensure competencies<sup>2,3</sup>. Entrustable Professional Activities (EPA) represents a unit of professional practice that is fully entrusted to a trainee after demonstrating the necessary competence to execute the tasks independently<sup>4</sup>. We describe a pragmatic EPA guided framework for surgical residents to ensure that they

**Table 1 Entrustable Professional Activities for Surgical Residents in Intensive Care Unit**

Entrustable Professional Activities	Knowledge	Skills	Attitudes and Behaviour	Assessments
Donning and doffing appropriate Personal Protective Equipment (PPE) during care of COVID-19 patients	<ul style="list-style-type: none"> <li>- Basic knowledge of what encompasses full PPE and individual-fitted N95 mask size</li> <li>- Infection control guidelines</li> </ul>	<ul style="list-style-type: none"> <li>- Check, assembly and troubleshoot Powered Air-Purifying Respirator (PAPR)</li> <li>- Don and doff PPE and PAPR</li> </ul>	<ul style="list-style-type: none"> <li>- Conscientious in infection control measures</li> <li>- Proactive alertness in assisting colleagues with infection control measures</li> </ul>	<ul style="list-style-type: none"> <li>- Direct Observation of Procedural Skills (DOPS): satisfactory observation of donning and doffing of PPE and PAPR by infection control team or trained assessors</li> <li>- Simulation: Protected cardiopulmonary resuscitation simulation</li> </ul>
Monitoring and assessing critically ill COVID-19 patients, seeking expert assistance when appropriate	<ul style="list-style-type: none"> <li>- Knowledge of disordered physiology and its clinical presentation</li> <li>- Early warning signs of impending clinical deterioration</li> <li>- Knowledge to perform appropriate investigations and interpretation of results</li> </ul>	<ul style="list-style-type: none"> <li>- Initial resuscitation of acutely ill patient</li> <li>- Recognize imminent deterioration trends in monitored parameters</li> <li>- Orders and perform relevant investigations</li> <li>- Integrate history, physical examination and investigations to form a differential diagnosis</li> </ul>	<ul style="list-style-type: none"> <li>- Initiate timely patient care</li> <li>- Attention to patient safety</li> <li>- Awareness of personal limitations and seeks and accept assistance as necessary</li> </ul>	<ul style="list-style-type: none"> <li>- Direct observation: Direct observation during daily rounds</li> <li>- Multisource feedback: Daily multi-professional morning meeting, involving intensivist, nurses and allied healthcare to discuss systems-related and patient care issues over last 24 hours</li> </ul>
Initiating and performing resuscitation for unstable COVID-19 patients	<ul style="list-style-type: none"> <li>- BCLS and ACLS protocols</li> <li>- Resuscitation drugs and pharmacology</li> <li>- Causes of cardio-respiratory arrest</li> <li>- Knowledge on aerosol generating procedure (AGP) which includes mask ventilation, intubation and chest compression, and appropriate PPE required</li> </ul>	<ul style="list-style-type: none"> <li>- Use emergency monitoring equipment</li> <li>- Use defibrillator safely</li> <li>- Perform relevant investigations (e.g arterial blood gas) during a resuscitation</li> <li>- Don and doff PPE and PAPR</li> </ul>	<ul style="list-style-type: none"> <li>- Rapid response and resuscitation</li> <li>- Attention to patient safety</li> <li>- Awareness of personal limitations and seeks and accept assistance as necessary</li> <li>- Communicate effectively during resuscitation</li> </ul>	<ul style="list-style-type: none"> <li>- Simulation: Protected cardiopulmonary resuscitation simulation</li> <li>- Valid BCLS and ACLS certification</li> </ul>
Initiating basic airway management and maintaining oxygenation in an emergency situation during care of COVID-19 patients	<ul style="list-style-type: none"> <li>- Signs and symptoms of acute respiratory failure</li> <li>- Interpretation of arterial blood gas and chest X-ray</li> <li>- Indications for non-invasive and invasive ventilation</li> <li>- Pharmacology of anesthetic drugs and muscle paralysis</li> <li>- Knowledge on AGP and appropriate PPE required</li> </ul>	<ul style="list-style-type: none"> <li>- Check and uses airway equipment</li> <li>- Mask ventilation with filter and tight seal</li> <li>- Ventilator set-up</li> </ul>	<ul style="list-style-type: none"> <li>- Rapid response and resuscitation</li> <li>- Attention to patient safety</li> <li>- Awareness of personal limitations and seeks and accept assistance as necessary</li> <li>- Communicate effectively with patient and family</li> </ul>	<ul style="list-style-type: none"> <li>- Simulation: Protection cardiopulmonary resuscitation simulation</li> <li>- Direct Observation of Procedural Skills (DOPS): Hands-on ventilator training and assessment by respiratory therapist or trained assessors</li> </ul>

Table 1 Continued				
Entrustable Professional Activities	Knowledge	Skills	Attitudes and Behaviour	Assessments
Recognizing the indications for proning COVID-19 patients, performing proning procedure and recognizing implications of prone position	<ul style="list-style-type: none"> <li>- Signs and symptoms of acute respiratory failure</li> <li>- Interpretation of arterial blood gas and chest X-ray</li> <li>- Indication and contraindication for prone position</li> <li>- Resuscitation in prone position</li> </ul>	<ul style="list-style-type: none"> <li>- Prepare equipment and emergency medications required for proning and supination</li> <li>- Perform proning and supination procedure</li> <li>- Identify complications of prone positioning</li> </ul>	<ul style="list-style-type: none"> <li>- Coordinate the logistics arrangement of proning and supination of COVID-19 patients</li> <li>- Teamwork in prone and supination procedure</li> </ul>	<ul style="list-style-type: none"> <li>- Simulation: Prone drill assessment</li> </ul>
Prescribing and using vasoactive drugs, sedatives, analgesics and fluids during care of critically ill COVID-19 patients	<ul style="list-style-type: none"> <li>- Pharmacology of vasoactive drugs, sedative and analgesics</li> <li>- Fluid management in COVID-19 patients</li> </ul>	<ul style="list-style-type: none"> <li>- Prescribing common ICU drugs using Electronic Medical Record</li> <li>- Using infusion pumps and syringe pumps</li> <li>- Accessing and using central venous lines</li> </ul>	<ul style="list-style-type: none"> <li>- Proactive review of Electronic Medical Records</li> </ul>	<ul style="list-style-type: none"> <li>- Direct observation: Direct observation during daily morning round by senior trainee or intensivist</li> <li>- Multisource feedback: Daily multi-professional morning meeting, involving intensivist, nurses and allied healthcare to discuss systems-related and patient care issues over last 24 hours</li> </ul>
Applying ICU care bundles to critically ill COVID-19 patients	<ul style="list-style-type: none"> <li>- Knowledge of institutional guidelines, protocols and care bundles</li> </ul>	<ul style="list-style-type: none"> <li>- Using Electronic Medical Record to prescribe care bundle</li> </ul>	<ul style="list-style-type: none"> <li>- Attention to patient safety</li> </ul>	<ul style="list-style-type: none"> <li>- Direct observation: Applying care bundles to a newly admitted patient</li> <li>- Direct observation during daily morning round by senior trainee or intensivist</li> <li>- Multisource feedback: Daily multi-professional morning meeting, involving intensivist, nurses and allied healthcare to discuss systems-related and patient care issues over last 24 hours</li> </ul>
Updating family members using video-conferencing devices	<ul style="list-style-type: none"> <li>- Hospital visitor policy for infectious diseases</li> <li>- Information technology security</li> <li>- Ethical principles: Autonomy, Confidentiality</li> </ul>	<ul style="list-style-type: none"> <li>- Use of video-conferencing applications</li> <li>- Communicate effectively with patients' family</li> </ul>	<ul style="list-style-type: none"> <li>- Compassion towards patient and family</li> <li>- Respect religious, social and cultural difference and expectations</li> <li>- Demonstrate ethical principles</li> </ul>	<ul style="list-style-type: none"> <li>- Direct observation: Direct observation by senior trainee or intensivist</li> <li>- Multisource feedback: Daily multi-professional morning meeting, involving intensivist, nurses and allied healthcare to discuss systems-related and patient care issues over last 24 hours</li> </ul>
Communicating and documenting tasks during daily ICU rounds and handovers	<ul style="list-style-type: none"> <li>- ICU workflow and orientation</li> <li>- ICU administrative forms</li> </ul>	<ul style="list-style-type: none"> <li>- Use Electronic Medical Records</li> <li>- Appropriate record keeping</li> </ul>	<ul style="list-style-type: none"> <li>- Accepts responsibilities</li> <li>- Proactive in patient care</li> <li>- Communicate and collaborate effectively with health care team members</li> </ul>	<ul style="list-style-type: none"> <li>- Direct observation: Direct observation during daily morning round by senior trainee or intensivist</li> <li>- Multisource feedback: Daily multi-professional morning meeting, involving intensivist, nurses and allied healthcare to discuss systems-related and patient care issues over last 24 hours</li> </ul>

*PPE* Personal Protective Equipment *PAPR* Powered Air-Purifying Respirator *BCLS* Basic Cardiac Life Support *ACLS* Advanced Cardiac Life Support *AGP* Aerosol Generating Procedure.




achieve the necessary competencies to provide safe and effective physician coverage of the ICU and high dependency wards.

The Accreditation Council for Graduate Medical Education-International (ACGME-I) residency curriculum mandates a one-month experience in the ICU during their second year of residency. Based on the ACGME-I competency-based goals, we hypothesized that a refresher course would allow them to function effectively and safely as an ICU team member. The proposed EPA seeks to guide the entrustment decision for surgical residents to be on nighttime duty in a COVID-19 ICU under supervision of an intensivist, with a Level 3 supervision (act with indirect, reactive supervision, *i.e.* readily available on request). The Institution Director of Critical Care, Clinical Director for Department of Surgery, Program Directors for Anesthesiology Residency and Surgical Residency and other intensivists formed the expert panel to define the EPA standards, while incorporating the competencies of Competency-based Training in Intensive Care Medicine in Europe (CoBaTrICE)<sup>5</sup>. Regular multi-professional meetings amongst various stakeholders such as intensivist, anesthesiologists, surgeons and educationalists were then conducted to validate the EPA content and workflow processes. The summary of EPAs with its specific knowledge, skills, attitudes are presented in Table 1.

This competency-based training, compared to time-based training and knowledge-based examination, caters to individuals with different learning abilities, adaptation to new environment and variable time required to achieve a defined outcome. Residents

who attain the entrustment for professional activities would first assume clinical responsibilities and ensure safe transition of duties to essential services. This strategy is designed to optimize resource utilization during the constrained COVID-19 environment. Nonetheless, we acknowledge the limitations of this rapid rollout of an EPA enabled rapid training initiative. The validation of EPA is usually through expert meetings, surveys, or the Delphi technique (successive rounds of survey among independent experts until agreement between expert is reached). However, these techniques may not be applicable logistically during a pandemic. Instead, we utilized regular multi-professional meetings as an avenue for open survey among all stakeholders which required mutual trust and common goal for improvement. In addition, the EPA described above described above were identified based on our institutional experience and may not be directly extrapolated to other institutions.

In conclusion, we use the EPA guided framework to ensure safety of patients and to optimize resources in the constrained COVID-19 environment. The practicality of EPA, as a framework for work-based learning standards, allows rapid rollout when the clinical demand rises rapidly and unexpectedly. We believe that the framework outlined above could be adapted by other centers with training programs to meet their local needs. This proposed framework could also be of guidance for the future when, ICU services need to be increased rapidly, such as for resurgence of COVID-19 post lock down, or after international travel restrictions are eased and for mass casualty incidents.

Theng Wai Foong<sup>1,2</sup> , Jarrod Kah Hwee Tan<sup>3</sup> , Balakrishnan Ashokka<sup>1,2</sup>, Rohit Agrawal<sup>1</sup>, Bettina Lieske<sup>3</sup>, Somnath Bose<sup>4</sup> , Dujeepta Samarasekera<sup>5</sup> and Fun Gee Chen<sup>1,6</sup>

<sup>1</sup>Department of Anesthesia and Surgical Intensive Care Unit, National University Hospital, Singapore,

<sup>2</sup>Department of Anesthesia, Yong Loo Lin School of Medicine, National University of Singapore, <sup>3</sup>Department of Surgery, University Surgical Cluster, National University Hospital, Singapore,

<sup>4</sup>Department of Anesthesia, Critical Care and Pain Medicine, Harvard Medical School, Beth Israel Deaconess Medical Center, United States, <sup>5</sup>Centre for Medical Education, Yong Loo Lin School of Medicine, National University of Singapore, and <sup>6</sup>Division of Graduate Medical Studies (DGMS), Yong Loo Lin School of Medicine, National University of Singapore

DOI: 10.1002/bjs.11949

- 1 Spinelli A, Pellino G. COVID-19 pandemic: perspectives on an unfolding crisis. *Br J Surg* 2020; **107**: 785–787.
- 2 Balakumar C, Montauban P, Rait J, Iqbal S, Burr T, Taleb K *et al.* Surgeons' response to COVID-19 - Preparing from the sideline. *Br J Surg* 2020; **107**: e192.
- 3 Cano-Valderrama O *et al.* Reduction in emergency surgery activity during COVID-19 pandemic in three Spanish hospitals. *Br J Surg* 2020; **107**: e239.
- 4 Ten Cate O, Chen HC, Hoff RG, Peters H, Bok H, van der Schaaf M. Curriculum development for the workplace using Entrustable Professional Activities (EPAs): AMEE Guide No. 99. *Med Teach* 2015; **37**: 983–1002.
- 5 CoBaTrICE Collaboration, Bion JF, Barrett H. Development of core competencies for an international training programme in intensive care medicine. *Intensive Care Med* 2006; **32**: 1371–1383.