

International training and assessment practices in Anesthesia and Intensive Care: what is the role of simulation?

Summary

As a training and evaluation modality, simulation is rapidly becoming a formative and summative (e.g., certification) assessment tool. This current trend is growing stronger with increasing numbers of published reports on this subject. The field of anesthesia has pioneered healthcare simulation use and development since its inception.(1–3) Simulation offers opportunities to explore not only technical skills, but "non-technical" skills, making it an essential part of teaching and assessment.(4–7) It is fundamental to rigorously and clearly define the framework and expectations of the use of simulation in this way.(3,4,8) What remains to be clarified, however, are which modalities would be best suited for teaching and/or assessing certain aptitudes (or skills), the validity of their use as described above, as well as the impacts on the learner.(9)

Using rigorous methodology, the objective of this project is to **elaborate an internationally agreed-upon repository of training in simulation for anesthesia and intensive care** consisting of a comprehensive variety of technical skills, entrustable professional activities and critical situations, in a framework of European, U.S., and Canadian collaboration that can serve as a support thereafter for formative and certification-based assessment.

Ultimately, this project aims to develop common and universal tools in a framework of North-American-European collaboration by associating European and North-American societies of Anesthesia and Intensive Care, as well as societies of simulation in healthcare.

Scientific context

The crucial role of simulation as an educational and assessment tool is no longer questionable in healthcare education. It is now necessary to determine the appropriate use of this powerful and advanced teaching modality. The fields of application remain to be defined through reference standards, particularly in anesthesia and intensive care.(3,4,8) Interest in simulation is reinforced because it is the only modality which allows users to work on and explore non-technical skills,(4,7) elements identified as frequently being involved in patient morbidity and mortality.(10–12) The idea of using simulation as an assessment modality naturally follows that of training.(13–17) Initial

development in healthcare simulation was based on simulation use in aviation.(18) Airplane pilots are first trained and then certified on simulators during their training, but also undergo recertification using simulation-based modalities during their professional lives. Such a concept is likely related to the extreme safety required in civil aviation activities. It is therefore logical to use healthcare simulation as an evaluation method after using it for training purposes.(13,14,16,17) Nevertheless it remains to be determined what are the ideal methods, validation criteria, and any impact on the learner of using simulation as an assessment tool. Any assessment tool may cause heightened emotions in learners. These simulation-based assessments created through this project need to be rigorously crafted to meet high educational standards, because they may be high-stakes in the learner's eyes if used for summative purposes. These standards must be defined so that the use of the simulation in this way is legitimate, valid and effective. Most of the history and progressive development of simulation has been and continues to be in the field of anesthesia, making this field a natural fit for this innovative approach.(9,19)

Objectives

Broadly speaking, anesthesia and intensive care can be thought of as relatively uniform across much of Europe, Canada, and the United States. However, it is unclear how uniform training practices are in these countries, and use of simulation for assessment in training is also not well-quantified.

The objective of this work is to **define in anesthesia and intensive care a repository of training in simulation** which includes technical skills, entrustable professional activities and critical situations, within a **framework of international collaboration** that can serve as a support thereafter for formative and certification-based assessment.

Material and methods

Three categories have been created to specifically explore the technical and procedural aspects and to cover as widely as possible the fields of knowledge and skills expected of anesthesiologists (20,21):

- Based-Simulation Competence & Skills (**BaSiCS**), which are self-management skills in common practice situations.
- Entrustable Professional Activities (**EPA**), which can be assigned to the resident for an autonomous realization without direct supervision)(22–25) and
- Crisis and Exceptional Situations in Simulation (**CrESiS**), which are critical and rare events, which require escalated care, self-management, and application of crisis resource management skills.

Based-Simulation Competence & Skills

The BaSiCS are based on a collection of all the technical procedures and procedures taught to anesthesia residents published in 2014 and on the ACGME Core Program Requirements for the anesthesia residency.(20,26) The initial list has been reprocessed into categories and some items have been grouped together. The list of BaSiCS proposed for the survey includes 52 items in 10 categories.

Entrustable Professional Activities

The EPAs are based on the work of Wismanz-Warter et al., published in 2016. Wismanz-Warter's work was based on the Netherlands' pedagogical objectives repository for resident in anesthesia and intensive care, of which 58 EPAs were initially proposed and 45 were selected using a Delphi method. These EPAs were compared with the European Training Requirements in Anesthesiology (ETR) developed in 2018 by the European Board of Anesthesiology and the European Union of Specialist Physicians(26) and the 2015 update of Milestones (MS) developed by the American Board of Anesthesiology and the Accreditation Council for Graduate Medical Education.(27) After comparisons were made between the EPA and the educational objectives of the ETR and MS, it was necessary to add 6 additional EPAs to those proposed by Wismanz-Warter et al. to cover the pedagogical objectives more completely. Others which were deemed redundant were removed. The proposed EPA list for the survey includes 58 items in 6 categories.

Crisis and Exceptional Situations in Simulation

The list of CrESiS comes from the second edition of Crisis Management in Anesthesiology 2014.(28) The proposed crisis situations were sorted by importance and grouped together to cover the widest possible range of non-technical skills while maintaining a number compatible with an implementation in a training program. Special attention has been given to ensuring that the non-technical skills corresponding to Anesthesia Crisis Resources Management are all addressed through these CrESiS. The list of CrESiS proposed for the survey includes 34 items in 10 categories.

Surveys

A **Delphi method survey in 3 rounds** will be conducted in **4 months** (February to May 2019) with three populations: the program director of anesthesia and intensive care, experts in simulation for anesthesia and intensive care and senior anesthesiologist graduates within the first 5 years of practice. The 3 categories (BASiCS, EPA, and CrESiS) will be the subject of identical but separate surveys so that the response time required for each survey is reasonable, compatible with the availability of responders and can optimize the response rate. The total time for each participant will be less than one hour for the whole 3 rounds of the survey.

Trios of participants will be recruited through networks of Scientific Societies in proportion to the country population and the number of anesthetists in the country according to the World Federation of Societies of Anaesthesiologists data from 2016.(29) With a minimum of 3 trios per country so that each country opinion is expressed on the 3 categories BaSiCS, EPA and CrESiS, **126 trios will be recruited in 20 countries**: Germany (12), Austria (3), Belgium (3), Denmark (3), Spain (6), France (9), Ireland (3), Italy (6), Netherlands (3), Poland (6), Portugal (3), United Kingdom (9), Sweden (3), Norway (3), Switzerland (3), USA (39), Canada (6), Israel (3) and Australia (3).

- **First round:**

The questions of the first round will aim to identify for each item if it is judged to be part of the curriculum, how often it is used in professional practice, what is the level of difficulty of the skill, in which year a resident can perform this item with indirect supervision, what is the preferential evaluation modality (clinical or simulation context), and if items are missing from the proposed lists, and a free-text answer box to capture any additional comments.

- **Second round :**

The questions of the second round will aim to validate the list of items having a high score and which are deemed to be kept, to validate the list of items having a low score and which are deemed to be discarded, to select items from the "gray zone" (average score) to be included in the list to be preserved and to validate the preferential assessment modality (clinical or simulation context).

- **Third round:**

The question of the third round will consist in the final validation of the lists of items thus constituted.

The data will be collected via a digital survey platform (LimeSurvey) whose data are stored in the servers of the University of Normandy Caen (France). The data will be anonymous in order to respect the anonymity of the responders. The data will then be analyzed using the SAS software.

The promotion and dissemination of the survey will be carried out through the research and professional networks of European and North-American societies of Anesthesia and Intensive Care, as well as Simulation. The following societies have pledged their support of this project: the French Society of Anesthesia and Intensive Care (SFAR), the French Speaking Society of Simulation in Healthcare (SoFraSimS), the Society in Europe for Simulation Applied to Medicine (SESAM) and the American Board of Anesthesiology (ABA) and the Society for Simulation in Healthcare (SSH) (Canadian Society of Anesthesiology (CAS) is involved and will give her support soon).

Expected results and future prospects

Expected results

The expected results are the development of an international training repository for simulation-based anesthesia and intensive care that can serve as a support for the development of assessment tools aimed at exploring skills and knowledge that for some have not previously been available for assessment. By allowing learners to better understand the deliberate elements in each entrustable professional activity, this will help the learners and programs focus their educational efforts in a more customized way. These include non-technical skills such as communication, leadership, team organization, prioritization, reassessment of a situation, among others.

Having a training repository developed and validated in a framework of international collaboration will be a major step forward for the educators involved in the training of residents, for the residents themselves, as well as for scientific societies ensuring consistent standards of training.

The following table illustrates a general presentation of the results, allowing for identification of the assessment's modality chosen through this process for items of each category (BaSiCS, EPA and CrESiS).

Assessment's Modality	BaSiCS	EPA	CrESiS
Simulation	<i>List of BaSiCS/sim</i>	<i>List of EPA/sim</i>	<i>List of CrESiS/sim</i>
Clinical	<i>List of BaSiCS/clinical</i>	<i>List of EPA/clinical</i>	<i>List of CrESiS/clinical</i>

Future prospects

The next step will be the construction and validation from this repository of practical training tools for the different categories BaSiCS, EPA and CrESiS, through international networks and according to the collaborations that it will be possible to establish taking into account cultural differences. These tools will be used for formative assessment at first and then summative after validation. The perspective is therefore to build a model allowing the use of simulation as an assessment tool for certification in anesthesia and intensive care, then recertification throughout the lives of healthcare professionals.

The multicentric approach to elaboration includes an international dimension of collaboration that reinforces the legitimacy and the "universal" aspect of the curriculum and the tools thus developed.

The long-term use of simulation as a (re) certification tool should lead to an improvement in the quality and safety of care delivered to patients, which will be an area for future study.

Bibliography

1. Weinger MB, Banerjee A, Burden AR, Mclvor WR, Boulet J, Cooper JB, et al. Simulation-based Assessment of the Management of Critical Events by Board-certified Anesthesiologists. *Anesthesiology*. 2017 Sep;127(3):475–89.
2. Boulet JR, Murray D. Review article: assessment in anesthesiology education. *Can J Anaesth*. 2012 Feb;59(2):182–92.
3. Cooper JB, Murray D. Simulation training and assessment: a more efficient method to develop expertise than apprenticeship. *Anesthesiology*. 2010 Jan;112(1):8–9.
4. Blum RH, Boulet JR, Cooper JB, Muret-Wagstaff SL, Harvard Assessment of Anesthesia Resident Performance Research Group. Simulation-based assessment to identify critical gaps in safe anesthesia resident performance. *Anesthesiology*. 2014 Jan;120(1):129–41.
5. Weinger MB, Burden AR, Steadman RH, Gaba DM. This is not a test!: Misconceptions surrounding the maintenance of certification in anesthesiology simulation course. *Anesthesiology*. 2014 Sep;121(3):655–9.
6. Steadman RH, Huang YM. Simulation for quality assurance in training, credentialing and maintenance of certification. *Best Pract Res Clin Anaesthesiol*. 2012 Mar;26(1):3–15.
7. Wong AH-W, Gang M, Szyld D, Mahoney H. Making an “Attitude Adjustment”: Using a Simulation-Enhanced Interprofessional Education Strategy to Improve Attitudes Toward Teamwork and Communication. *Simul Healthc*. 2016 Apr;11(2):117–25.
8. Isaak RS, Chen F, Arora H, Martinelli SM, Zvara DA, Stiegler MP. A Descriptive Survey of Anesthesiology Residency Simulation Programs: How Are Programs Preparing Residents for the New American Board of Anesthesiology APPLIED Certification Examination? *Anesth Analg*. 2017 Sep;125(3):991–8.
9. Banerjee A. Using Simulation for Primary Certification. *Int Anesthesiol Clin*. 2015;53(4):42–59.
10. Institute of Medicine (US) Committee on Quality of Health Care in America. To Err is Human: Building a Safer Health System [Internet]. Kohn LT, Corrigan JM, Donaldson MS, editors. Washington (DC): National Academies Press (US); 2000 [cited 2018 Jan 17]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK225182/>
11. DREES. Enquêtes ENEIS 2004 et 2009, DREES, exploitation CCECQA. [Internet]. 2012 [cited 2017 Nov 15]. Available from: <http://drees.solidarites-sante.gouv.fr/IMG/pdf/dossier24.pdf>
12. Makary MA, Daniel M. Medical error-the third leading cause of death in the US. *BMJ*. 2016 03;353:i2139.
13. Szyld D, Uquillas K, Green BR, Yavner SD, Song H, Nick MW, et al. Improving the Clinical Skills Performance of Graduating Medical Students Using “WISE OnCall,” a Multimedia Educational Module. *Simul Healthc*. 2017 Oct 25;
14. Winkel AF, Gillespie C, Uquillas K, Zabar S, Szyld D. Assessment of Developmental Progress Using an Objective Structured Clinical Examination-Simulation Hybrid Examination for Obstetrics and Gynecology Residents. *J Surg Educ*. 2016 Apr;73(2):230–7.
15. Patrawalla P, Eisen LA, Shiloh A, Shah BJ, Savenkov O, Wise W, et al. Development and Validation of an Assessment Tool for Competency in Critical Care Ultrasound. *J Grad Med Educ*. 2015 Dec;7(4):567–73.
16. Norcini JJ, Lipner RS, Grosso LJ. Assessment in the context of licensure and certification. *Teach Learn Med*. 2013;25 Suppl 1:S62–67.
17. Macario A. Can physician performance be assessed via simulation? *Anesthesiology*. 2014 Jan;120(1):18–21.

18. Cooper JB, Taqueti VR. A brief history of the development of mannequin simulators for clinical education and training. *Qual Saf Health Care*. 2004 Oct;13 Suppl 1:i11-18.
19. Chiu M, Tarshis J, Antoniou A, Bosma TL, Burjorjee JE, Cowie N, et al. Simulation-based assessment of anesthesiology residents' competence: development and implementation of the Canadian National Anesthesiology Simulation Curriculum (CanNASC). *Can J Anaesth*. 2016 Dec;63(12):1357–63.
20. Accreditation Council for Graduate Medical Education (ACGME). Common Program Requirements (Residency) [Internet]. 2018 [cited 2018 Dec 19]. Available from: <https://www.acgme.org/Portals/0/PFAssets/ProgramRequirements/CPRResidency2019.pdf>
21. Committee on Education and Professional Development (EPD) of the Section and Board of Anesthesiology. UEMS - European Training Requirement ETR in Anaesthesiology [Internet]. Union Européenne des Médecins Spécialistes. 2018 [cited 2018 Dec 19]. Available from: https://www.uems.eu/___data/assets/pdf_file/0003/64398/UEMS-2018.17-European-Training-Requirements-in-Anaesthesiology.pdf
22. Jonker G, Hoff RG, Ten Cate OTJ. A case for competency-based anaesthesiology training with entrustable professional activities: an agenda for development and research. *Eur J Anaesthesiol*. 2015 Feb;32(2):71–6.
23. Ten Cate O. Entrustment Decisions: Bringing the Patient Into the Assessment Equation. *Acad Med*. 2017;92(6):736–8.
24. Wisman-Zwarter N, van der Schaaf M, Ten Cate O, Jonker G, van Klei WA, Hoff RG. Transforming the learning outcomes of anaesthesiology training into entrustable professional activities: A Delphi study. *Eur J Anaesthesiol*. 2016 Aug;33(8):559–67.
25. Savoldelli GL, Van Gessel EF. “Entrustable professional activities”: the way to go for competency-based curriculum? *Eur J Anaesthesiol*. 2016;33(8):557–8.
26. Dhollander A-A, Debaene B, Guyonnaud O, Labadie M, Desachy A, Levrat Q, et al. Enquête sur la diversité des actes techniques pratiqués et/ou enseignés aux internes dans un réseau de formation régional en anesthésie-réanimation. Résultats qualitatifs préliminaires. *Annales Françaises d’Anesthésie et de Réanimation*. 2014 Sep 1;33:A365.
27. Accreditation Council for Graduate Medical Education (ACGME), American Board of Anesthesiology (ABA). The Anesthesiology Milestones Project [Internet]. 2015 [cited 2018 Dec 19]. Available from: <https://www.acgme.org/Portals/0/PDFs/Milestones/AnesthesiologyMilestones.pdf?ver=2015-11-06-120534-217>
28. Gaba DM, Fish KJ, Howard SK, Burden AR, Gaba DM, editors. *Crisis management in anesthesiology*. Second edition. Philadelphia, PA: Elsevier/Saunders; 2015. 409 p.
29. World Federation of Societies of Anaesthesiologists. World Anaesthesiology Workforce [Internet]. [cited 2019 Jan 22]. Available from: <https://www.wfsahq.org/workforce-map>