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"Simulate, or not to simulate?"

Evolution in medicine and the anaesthesia context

A brief discussion about the importance and the state of the art of simulation in anaesthesia and intensive care medicine.

Training in simulation plays a key role in complex systems such as aviation and the nuclear industry, to investigate predictable errors that lead to adverse outcomes. The advancement made by aviation integrating simulation in training over the past years is relevant, whereas in medicine simulation remains marginal, but is now rising in use. In medicine we are asking if simulation really works and if there is a place for it in medical training. Perhaps the answer is yes.

In the last few years, the use of mannequin-based simulation has become a mainstay in physician education in particular through the Basic Life Support (BLS), the Advanced Life Support (ALS) or the Advanced Trauma Life Support (ATLS) (Miyasaka et al. 2015). The American College of Critical Care Medicine recommended the use of simulation to enhance resident training in critical care (Dorman et al. 2004). Furthermore, the Institute of Medicine report *To Err is Human* suggested simulation training to reduce preventable errors (Kohn et al. 2000).

In the USA about 98,000 deaths per year are due to medical errors, more than vehicle accidents, cancer or AIDS (Kohn et al. 2000). In Canada, around 7.5% of hospital admissions will result in an adverse event (Naik and Brien 2013).

So, what is our answer to this evidence?

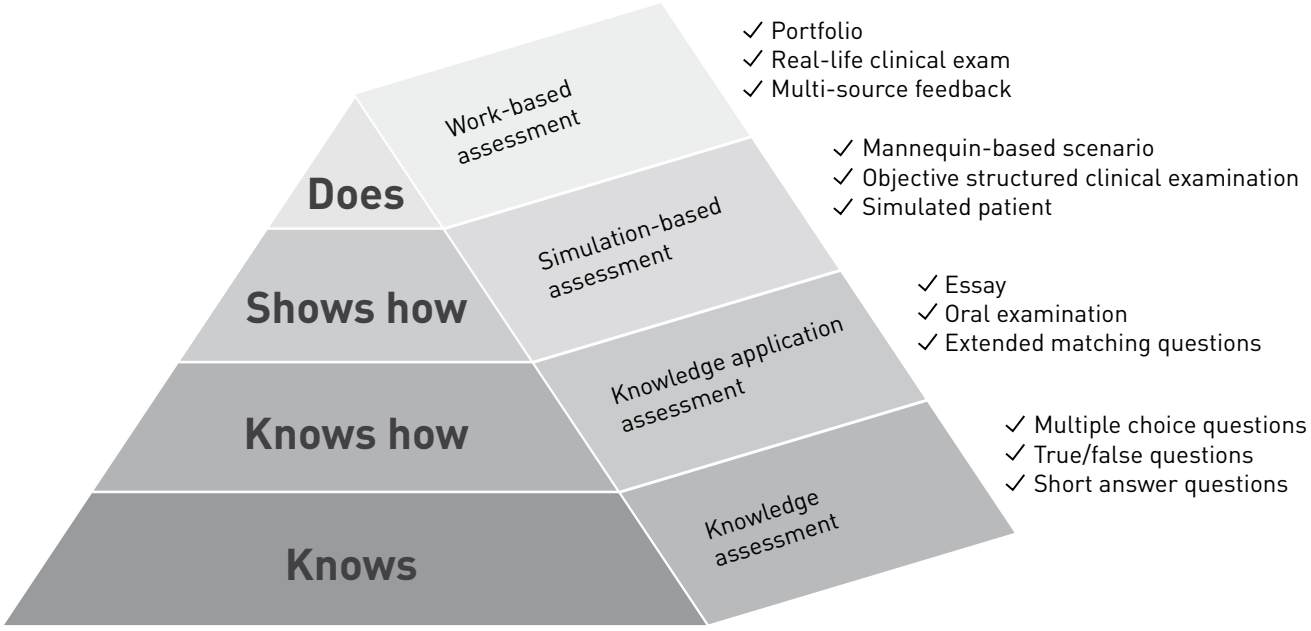
Can we be sure that we are educating students and trainees in the most effective way possible? On the contrary, Dudeck et al. affirmed that our programmes are not always able to identify underperforming residents and that the lack of evaluating documentation leads to undefined level of competence. Too often, current trainees are assessed using poorly and non-standardised metrics (Levine and Shorten 2016; Dudeck et al. 2015).

Educational programmes

Strong evidence supports the importance of increasing physicians and healthcare professional's competencies with a broader set to improve the healthcare system (Naik and Brien 2013). For this reason, many countries developed a lot of projects aimed at creating simulation-based assessment including essential skills, technical and non-technical, for the practitioner.

> **"simulation scenarios allow learners deliberate practice of crisis management with no risk for patient safety or quality of care"**

In the literature, many articles have tried to develop, implement and evaluate a set of consensus-driven standardised simulation scenarios (mannequin-based) that each trainee must complete satisfactorily prior to completion of certification for anaesthesiology residents (Chiu et al. 2016), paediatric residents (Mitzman et al. 2017; Bank et al. 2015), obstetrics and gynaecology residents, management of trauma and surgical critical care patients (Miyasaka et al. 2015). The authors describe methods to achieve competencies that should be included in the educational programmes. They usually employ the Delphi Method through a task force of experts. None of the papers go into detail about the contents selected or include the simulation scenarios list chosen for each subject, however.



Source: Miller (1990)

This kind of training refers to Miller's pyramid competence, which sustains the progression from "knows" and "knows how" to "shows how" and "does" (Jonker et al. 2017). Simulation scenarios allow learners deliberate practice of crisis management with no risk for patient safety or quality of care, and if designed for evaluation, permit the "shows how" level of assessment (Jonker et al. 2017).

Simulation in anaesthesia

Training in simulation fits well with the resident's educational path in anaesthesia and intensive care. In Europe there is a wide variability of training programmes in different countries. In 2012, the Union of European Medical Specialists issued the latest revision of their guidelines on Training Requirements for the Specialty of Anaesthesia, Pain and Intensive Care Medicine. These guidelines aim to harmonise postgraduate educational courses to facilitate transfer of anaesthetists across Europe (Espey et al. 2017).

Through an online survey, Jonker et al. (2017) collected a description of European training programmes in three types of board:

- Knowledge-based (with final exam oral or written),
- Knowledge- and skills-based (with a specified number of procedures evidenced by a logbook),
- Competency-based (with workplace assessment).

Many countries are now evolving towards a competency-based approach to training, using a larger number of assessment tools to support trainees' competence. Establishing learning outcomes that can be assessed to guarantee a required level of competence of all European anaesthetists demands ongoing effort. In this optic, the future role of simulation in anaesthesia will increase. In one study, a simulation-based curriculum improved performance scores in management of medical emergencies and should be incorporated into residency education (Barra et al. 2018). Training for novice residents through simulation courses is effective and safe to rapidly acquire and develop basic skills specific to anaesthesiology (Barsuk et al. 2009a).

Technical and non-technical skills in anaesthesia

The literature supports the use of simulation to educate and improve technical skills (TS) and non-technical skills (NTS): Naik and Brien (2013) define TS such as medical knowledge and procedural ability mapped to a larger group of competencies; NTS are identified as task management, teamwork, leadership, situational awareness and decision-making.

Technology is a crucial tool supporting development, teaching and achievement of practical abilities in safe environments. It allows participants to try and to make mistakes without discomfort or risks for patients.

In the anaesthesia context a simulation-based education is useful in procedures to reduce adverse outcomes and technical error and to shorten learning curves, i.e. catheter bloodstream infection (Barsuk et al. 2009a), central venous catheter placement (Barsuk et al. 2009b), lumbar puncture skill (Barsuk et al. 2012), ultrasound use in loco-regional anaesthesia (De Oliveira Filho et al. 2017), endotracheal intubation (Howells et al. 1973) and airway management in general (Stringer et al. 2002; Cumin and Merry 2007).

Instead, NTS are more difficult to practise and evaluate. Probably more time is required to develop programmes to train and to expand these skills, aware of their contribution to system errors, morbidity and mortality. It is estimated that about 70-80% of medical errors are attributable to failing in these contexts (Flin et al. 2017). Without balanced curriculum design, the

challenge in teaching NTS for patient safety can result in their overall marginalisation (Naik and Brien 2013).

Human behaviour is a variable that can influence task execution and it plays a crucial role in the anaesthesia context in relation to NTS. These types of competences can be described as crew resource management or crisis resource management (CRM) (Flin and Maran 2015).

"it remains uncertain how to measure the real transfer of simulation training into clinical practice"

Anaesthesiologists do not typically receive training in CRM, although they are called upon to manage life-threatening crises at a moment's notice. A recent paper demonstrated that CRM training for team leaders only is more effective than mere clinical training of team members (Castealo et al. 2015).

Over the last decade, the description of NTS with taxonomies has allowed the identification of essential skills for anaesthetic practitioners:

1. situation awareness, monitoring of the task and noticing changes in the environment
2. decision-making, reaching a judgment, selecting an option and choosing the action to do
3. teamwork, maintenance of team harmony, colleagues' motivation and coordination using both verbal and non-verbal communication
4. leadership, managing personnel and material resources
5. coping with stress
6. managing fatigue.

In order to develop these tasks through simulation-based training programmes, scenarios and debriefing of scenarios allow participants to identify and analyse effective and less effective behaviours that impact on patients' outcomes. It is clear that, for simulation, both quality and frequency of experience are important in terms of impact on clinical practice and patient's safety: they must be considered and determined.

In recent years, the American Society of Anesthesiology decided to integrate simulation-based training with Maintenance of Certification in Anesthesiology (MOCA) (Steadman and Huang 2012). High-fidelity simulation increased retention of skills and so improved learner outcomes. As healthcare professionals, we must be ready to demonstrate our skills and the maintenance of proficiency. To do this in the best way possible training and re-training in simulation should be a useful opportunity (Krage and Erwteman 2015) .

It remains uncertain how to measure the real transfer of simulation training into clinical practice. So, more research studies are needed in the future to establish the improvement in terms of clinical performance, patient outcome and maintenance of competences. Our hope is that each nation will implement and integrate training programmes with a simulation-based curriculum, in order to standardise curricula and the approach to clinical practice respecting different features and characteristics. Ordinary use of simulation may prepare our next generation of medical educators. ■

Conflict of interest

None declared.

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