

## Medical simulation in paediatric anaesthesia

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Paediatric anaesthesia presents unique challenges. High-risk patients, premature babies, neonates, infants, small toddlers and children with multiple congenital anomalies are included in this group of patients. Infants and neonates are more at risk of an adverse incident perioperatively and also suffer higher morbidity and mortality than older children.

Centralisation of tertiary paediatric services and reduced working and training hours present a challenge to the training and maintenance of paediatric anaesthesia skills. In many countries, paediatric emergencies and surgery are often managed outside tertiary paediatric centres. The provided care may be given by doctors and nurses who only have occasional exposure to paediatric patients. The care of paediatric patients involves anaesthetists and competent medical and nursing support in the perioperative period.

Medical simulation creates a realistic, safe and reproducible setting or environment that represents a clinical scenario for medical training. Medical simulation utilises standardised patients, a computer-based system, part-task trainers and full-body mannequins.

Full-body paediatric mannequins, available in neonatal, infant and child sizes, have realistic vital signs and clinical features, airways (tongue swelling and stridor), breathing patterns and sounds, cardiovascular characteristics (heart sounds and murmurs), and other signs such as abdominal distension, seizures and bulging fontanelle. These mannequins can be intubated and cannulated (intravenous and intraosseous) and can have chest tubes inserted. Clinical feedback on treatment and interventions facilitates an immersive clinical experience for participants.

Medical simulation allows deliberate practice and repeated exposure to common complications, including upper airway

obstruction, e.g. laryngospasm, or uncommon events, e.g. anaphylaxis or malignant hyperpyrexia. Hence, medical simulation is useful for trainees, but also for specialists to maintain their skills in the event of rare adverse events.

Utilisation of simulation technology is valuable for the teaching of technical and clinical skills. However, effective management of a medical crisis depends on good team interaction, i.e. nontechnical skills such as situation awareness, teamwork, leadership, communication and decision-making. Team simulation training can be used to promote collaborative practice within each clinical area and also across disciplines, e.g. trauma codes that involve emergency staff, surgeons and anaesthetists.

Paediatric anaesthesia involves the clinical management of children, as well as having rapport with parents. This is important. Communication skills are required to take informed consent, deal with difficult parents and deliver bad news. Scenarios that are built into medical simulation can involve communication exercises.

Studies that use high-fidelity simulation have found advanced cognitive performance in paediatric house staff with regard to mock resuscitation, and a significant improvement in the performance of the paediatric trauma team after simulation training.

Medical simulation is time intensive, both for the faculty and participants. Hence faculty training and dedication is important to ensure that the learners reap the maximum benefit.

It is not important to have the most expensive simulator systems, or the most realistic physical setting, e.g. a fully outfitted operating theatre. An effective medical simulation

programme requires the appropriate “hardware” and quality “software”, i.e. a trained and dedicated faculty with good technical support.

Medical scenarios should reflect real-life medical events. The temptation to pile crisis upon crisis should be avoided. The medical scenario should have clear objectives and outcomes that match the participant’s level. Repeated medical simulation exposure also helps with the retention of knowledge and skills.

Debriefing is critical for an effective learning experience. Through an interactive and guided discussion, performance gaps can be identified. Together, the faculty and participant can resolve events, interpret what happened, close the gaps and develop strategies to improve clinical performance.

There is increasing robust evidence in support of medical simulation as a training tool to facilitate improvement in clinical patient outcomes and long-term changes in the attitude and behaviour of participants.

Medical simulation is increasing being utilised as an assessment tool during formative training, whereby the primary goal is to provide feedback on the learner’s strengths and weaknesses.

The use of medical simulation during a high-stakes exam is still often debated. Certain clinical conditions cannot be replicated on even the most sophisticated mannequins. Scores that are used in assessment must reflect true ability. Do the scores have predictive validity? In other words, will performance on a given assessment predict future performance in actual practice? Inter-rater consistency and reliability must also be ensured.

The Israeli National Board Examination in Anesthesiology has incorporated a simulation-based, objective structured clinical examination into their exams. The American Board of Anesthesiology has mandated participation in medical

simulation as part of its requirements for the maintenance of re-certification. Insurance premium incentives are offered to anaesthesiologists who participate in medical simulation in the Harvard medical community.

Medical simulation technology is expensive. There are still limitations with regard to fidelity in many clinical situations. Nevertheless, it is here to stay as the opportunities to practise patient care without compromising the safety of real patients and teamwork is valuable.

Cost and time are an issue, but expenses and trainers can be shared across disciplines or hospital groups.

A dedicated faculty that is trained in simulation use and debriefing is critical. The commitment of administrators to release medical and nursing staff for training is also important. Finally, medical simulation enhances but cannot replace good patient bedside teaching or intraoperative learning experience.

### Recommended reading

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