

## Symposium

### Simulation Training in Neonatology - Setting the context

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#### ABSTRACT

Appropriate management of neonatal emergencies not only requires knowledge and skills but also effective teamwork. Adults are experiential learners who learn by reflecting on the clinical situation they were involved with. Simulation is an effective tool to train as a team and also learn by reflection in a safe environment. Simulation brings out the human factors, which significantly contributes to medical errors and helps train in crisis resource management. Simulation based training is now recommended by resuscitation councils worldwide. In neonatal training, simulation can be used as a tool in many contexts – learning psychomotor skills, identifying knowledge gaps, communication skills and teamwork. In situ simulation will also help test the systems. We describe some key contexts wherein simulation based training can be used effectively as a tool to improve clinical care and enhance quality in neonatal medicine.

**Keywords:** Neonatal Simulation, Crisis Resource Management, Deliberate practice, in-situ simulation, breaking bad news.

Management of neonatal emergencies in delivery room and in the intensive care unit setting requires the ability to integrate the knowledge, technical competence and interpersonal skills of the entire team. While traditional teaching methods cater to acquisition of knowledge and to an extent practical competency, effective management of neonatal emergencies is a complex interplay of 'human factors.'<sup>1-3</sup> In conventional didactic teaching and apprenticeship training there is usually no formal training in teamwork and management of team dynamics. A large body of research into how adult learning is different has prompted new paradigms of teaching based on adult learning theories.<sup>4</sup> Adult learners are experiential learners and most learning happens participating in and then reflecting on a clinical incident.

It is increasingly being recognised that retention of skills in neonatal resuscitation is a concern.<sup>5</sup> Human factors contribute significantly to medical errors, which may result in ineffective resuscitation.<sup>6</sup> Simulation provides an opportunity to bring out the

human factors and helps learners to deploy crisis management tools to overcome and prevent human factor related errors. Simulation allows learning by participation in a recreated clinical environment and then most importantly reflection of performance during the debriefing. It enables to 'train as a team'. Hence, various resuscitation councils around the world are now bringing team training into their formal courses.<sup>7,8</sup> However, the relevance of Simulation based training is not restricted to formal resuscitation courses; in fact it has most relevance at the place of work.

As we run more and more simulation based courses we realise how professionals are readily relating to the effectiveness of the same. We discuss a few key contexts in which simulation based learning could be an effective tool in neonatal practice. Simulation can be used to learn practical skills like intubation, effective bag mask ventilation, and chest drain placement. In-Situ simulation can test 'systems' real time and also is a powerful quality improvement tool. Crisis management, identification of human as well as system factors in errors, exposing gaps in knowledge and deliberate practice in "non-technical" skills such as communication can be effectively delivered. We believe that widespread use of simulation in neonatal settings will help improve quality and patient outcomes.

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### **Context One: 'Team Training for effective Crisis Management'**

You have a team of doctors and nurses who are Neonatal Resuscitation Program (NRP) providers and have a few years of experience in handling neonatal emergencies. However, in the last three emergencies on the labour ward there were reports of ineffective teamwork that lead to delays in responding according to NRP steps and potential adverse patient outcomes. You review key steps in resuscitation with providers and they are able to demonstrate key steps of the NRP effectively. Thus you are comfortable that knowledge and technical skills are not what led to an uncoordinated and ineffective resuscitation. You design a mock scenario and simulate a baby born flat after massive antepartum haemorrhage; During debriefing the team reflected and identified that there was delay in calling for help, failure to anticipate severely depressed neonate, and lack of role allocation and clarity of leadership. This resulted in panic, failure to recognise ineffective resuscitation techniques and deviation from algorithm.

This exercise in simulation allowed learners to deliberate on Crisis Resource Management tools – Calling for help, using all available resources/information and role allocation. It has enabled adult learners to perform in a safe environment through experiential learning with the key aspect of reflection. Now they have some tools to use in the next emergency on the labour ward and optimize patient care.

### **Context Two: Testing the Systems**

The last few premature babies admitted to your unit have suboptimal temperature. You want to improve thermoregulation measures to improve clinical outcome. You have a unit protocol of using overhead warmer, plastic bag and cap for all neonates born <32 weeks and all the providers are trained to do the same.

You run a few *in-situ* Simulations of a preterm delivery both in the delivery room and operation theatre (OT). It emerges that the OT temperature is not maintained above the recommended 25C, the transport incubator was not plugged in and had a low temperature alarm that was ignored.

This exercise allowed you to identify system errors that resulted in low admission temperatures in

preterm, which now can be prevented and patient outcomes improved.

### **Context 3: Identifying gaps in knowledge**

Your trainees have recently attended lectures on ventilation strategies in preterm neonates and you want to test how they would apply their knowledge. You run a mock scenario of a preterm neonate who is on ventilator - a 27-week baby with a weight of 900gms was intubated and has received surfactant 3 hours prior. The nurse calls the trainee to ask them what they want to do with the following results of an arterial blood gas: pH of 7.38, pCO<sub>2</sub> of 22, paO<sub>2</sub> of 38, HCO<sub>3</sub> 18, BE -8. The trainee can demonstrate their decision making process by looking at the ventilator settings and flow loops, evaluating the baby's vital signs and breath sounds. The baby is on SIPPV with VG and is achieving vT of 5 ml and using pressures of 20/5 (PIP/PEEP). The baby has good respiratory drive and is breathing at 70 per minute. The trainee correctly identifies hypoxemia and hypocarbia as a potential issue. He wants to reduce the back up rate from 40 to 30 per minute. The nurse questions this as she knows that in SIPPV or A/C all the breaths that baby takes will be supported and reducing the back up rate in a baby triggering as many breaths will not achieve reduction in CO<sub>2</sub> wash out.

This exercise provided an opportunity to establish a gap in knowledge in modes of ventilation, decision-making and potentially issues with communication skills. During your debriefing you can help the trainee identify the better strategy of dropping set tidal volume and also to think about if a cause for metabolic acidosis needs to be identified and corrected. The trainee is able to internalise this information better than when delivered on a power point slide especially when they are able to reflect on and then fill their knowledge gap.

### **Context 4: Deliberate practice and mastery of practical skills**

You have new residents who are not confident in their intubation skills. Also there have been a few accidental extubations and it is felt that the E.T. tube was not secured very well with adhesive tapes. You have planned to intubate a 29 weeker for respiratory distress and increasing oxygen requirement on nasal CPAP

at 4 hours of life. You supervise the trainee doctor to practice intubation on a manikin, guide him through proper positioning, use of laryngoscope, preintubation medication, oxygenation, visualisation of cords and appropriate depth of insertion. He practises this a few times on the manikin until he can perform the procedure without any coaching on the steps or psychomotor skills. The nurse assisting also demonstrates proper ET fixation technique on the manikin. The trainee then immediately proceeds to intubate the preterm neonate and does it with confidence and in a very smooth manner. ET fixation is done well.

It has been shown that retention of key technical skills critical for neonatal resuscitation can be very poor. Using a mastery-learning model through deliberate practice has been shown to improve competency in technical skills. In addition, this is an example of a just-in-time training paradigm where the ability to accomplish the required skill is able to be ensured just prior to actual performance.

### Context 5: Improving Communication Skills

A two-week-old 29-weeker develops severe NEC on the unit. Your senior resident calls in the parent urgently to inform and seek consent for emergency surgery. The father's reaction is violent and he becomes extremely abusive.

You arrange a simulated breaking the bad news session with an actor for the resident. A 25-week baby has developed grade 3 bilateral IVH and has become hemodynamically unstable. The parent is to be given the information and told about guarded prognosis. The event is recorded on videotape and played back. During debriefing it emerges that the resident could have checked for prior knowledge, avoided using jargon and given information in small chunks. There was poor eye contact, no time allowed for parent to react to the news before more information was provided. The poor prognosis was not conveyed in clear terms as father became very tearful. The trainee was able to reflect on these points and has strategized ways to improve after discussion with his mentor.

Communicating bad news to families is hard to teach effectively without the use of simulation. There is more chance of getting it wrong than right without proper training. Using simulation to teach in communication skills allows for trainees to apply and test their own strategies, practice using algorithms like SPIKES<sup>9</sup> improve communication skills by learning to choose correct words and become comfortable with allowing parents to express emotions and the use of empathy. In summary, simulation is a critical learning tool that can be used to improve delivery of patient care and thus ultimately patient outcomes.

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