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Update on simulation for the Neonatal Resuscitation Program

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ABSTRACT

The goal of the Neonatal Resuscitation Program is to have a trained provider in neonatal resuscitation at every delivery. The Neonatal Resuscitation Program develops its course content on review of the scientific evidence available for the resuscitation of newborns. Just as importantly, the educational structure and delivery of the course are based on evidence and educational theory. Thus, as simulation became a more accepted model in medical education and evidence was developing suggesting benefit of simulation, the Neonatal Resuscitation Program officially added simulation into its courses in 2010. Simulation-based medical education is now an integral part of the Neonatal Resuscitation Program courses both in teaching the psychomotor skills as well as the teamwork skills needed for effective newborn resuscitations. While there is evidence, as in other fields, suggesting that simulation for teaching newborn resuscitation is beneficial whether using high- or low-technology manikins or video-assisted debriefing or not, there are still many unanswered questions as to best practice and patient outcome effects.

Brief rationale for using simulation in resuscitation training

The majority of newborns transition from the intra-uterine to the extra-uterine environment easily and need little to no assistance from providers in the delivery room. However, it is estimated that 10% of newborns need some intervention in the delivery room to establish spontaneous respirations and approximately 1% need more extensive resuscitations.[1] Given the relative infrequency of newborns needing intervention, it is rare that an individual provider will use these skills on a regular basis and even rarer that the providers responding will have done so together as a team.

Given the relative infrequency of newborns who need intensive resuscitations, the delivery room can be a very stressful place when newborns require more than routine care. The care teams must know the proper steps of neonatal resuscitation, be able to perform the technical procedures, and work effectively as a team. It has been shown that there are deficiencies in basic Neonatal Resuscitation Program (NRP) psychomotor skills as well as lack of adherence to the recommended NRP flow diagram steps in actual delivery room resuscitations.[2,3] Simulation is an ideal educational methodology to teach these cognitive, technical, and behavioral skills and hopefully improve delivery of care.

Simulation has been shown to better prepare providers to perform in the clinical arena, as compared with traditional

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educational methods. Even more importantly, there is translational evidence that providers who have completed simulation-based training in Adult Cardiopulmonary Life Support better adhere to resuscitation guidelines in the actual clinical environment.[4] Prior to the accumulation of evidence supporting the use of simulation for resuscitation training, the NRP had appreciated the benefits of this technique and incorporated simulation into all NRP courses.

Simulation and NRP

The NRP was launched as an education program in 1987, with a goal of ensuring that at least one person trained in neonatal resuscitation would be available at every birth in the hospital setting.[5] Early in its development, NRP focused on both building an evidence base for the practice of neonatal resuscitation, as well as defining optimal educational strategies to teach principles and skill sets to allow for the implementation of these evidence-based practices. In addition to these cognitive and technical goals, it was also recognized that various professionals with different training backgrounds, skill sets, and roles would be involved in neonatal resuscitation, often working together in teams.

The importance of teamwork and behavioral skills in the context of neonatal resuscitation gained prominence in the early 2000s. The Joint Commission published a Sentinel Event Alert on infant death or permanent disability in 2004 noting that communication issues were the most common root cause (72%) and that failure to function as a team was a barrier to effective communication.[6] Thus, it was clear that NRP needed to adopt team training into its educational courses.

Lou Halamek conducted a series of trials and proposed that simulation-based training in an immersive environment that replicates a real clinical scenario could facilitate training in behavioral and communication skills.[7,8] Eric Thomas translated principles of communication and teamwork behavior from the aviation industry to neonatal resuscitation practice and developed a framework for assessing teamwork behavior using video recordings.[9,10] In randomized trials testing the addition of teamwork training to NRP, those who received the teamwork training intervention not only exhibited more teamwork behavior but also completed resuscitations faster than the control group.[11,12] Behaviors more frequently seen in the intervention group included information sharing, inquiry, vigilance, and workload management. The addition of high-technology simulators increased the impact of teamwork training.[11]

The NRP strategies for teaching as well as the instructional materials for use have been regularly updated to optimize the learning experience. The fifth edition, released in 2005, included a multimedia CD-ROM and DVD, which included procedural demonstrations such as umbilical catheterization and needle thoracentesis, and video scenarios to complement each of the lessons of the NRP Textbook.[13] The videos included examples of simulated deliveries and counseling. These supplements to the textbook signaled a movement toward a more learner-centered educational strategy.

While it may now seem commonplace, the shift from the instructor-driven didactic lectures and skill demonstrations to participation in an interactive simulation and debriefing-based learning were an innovative transition that occurred with the implementation of the sixth edition of NRP in 2010.[1] The NRP continues to utilize this strategy, and has developed additional tools for instructors and learners in the seventh edition for acquisition of NRP skills.[14] The International Liaison Committee on Resuscitation (ILCOR) reviews evidence on resuscitation science over a 5-year cycle. While the main emphasis of ILCOR review is on the clinical aspects of resuscitation, there are also questions concerned with how to best conduct training. For example, the latest recommendations from ILCOR published in 2015 included a review of the frequency of resuscitation training.[15] Ongoing research in healthcare education broadly and specific to neonatal resuscitation will inform the future evolution of NRP.

NRP courses and simulation

As NRP has its foundations in best educational practices for effective delivery of content material to adult learners, the transition to a simulation-based educational framework was grounded in educational theory. NRP provides extensive resources for instructors on how to effectively incorporate simulation into their NRP courses. Simulation is currently used in NRP courses for both formative (skills stations) and summative (integrated skill stations) assessments. In addition, once the summative assessment is completed successfully, learners are required to participate in a multidisciplinary simulation focusing on communication and team behaviors.

A provider course contains the following areas of emphasis: acquisition of knowledge on relevant content, most of which are completed via self-study; a skills component, which is supervised by the instructor and utilizes deliberate practice in a mastery learning model to acquire procedural skills and the steps of resuscitation; and the team simulations. The course can be adjusted to the individual learners' needs and level of experience. Thus, more experienced learners might start with the summative assessment of the integrated skills stations. However, if they were noted to struggle with particular skills, they would need to complete the formative individual skills stations before progressing to the simulations, which are more complex and are designed to focus on team training.

NRP is a good example of the Learn, See, Practice, Prove, Do, Maintain (LSPPDM) model of skill acquisition and maintenance in practice.[16] The LSPPDM model was developed after a critical synthesis and review of the literature supporting educational and instructional design best practices. As NRP recommendations for the structure of NRP courses is based in educational theory and evidence, it is not surprising that many of the NRP course components nicely fit into the structure outlined by LSPPDM. The following will describe how NRP fits into this model with particular emphasis on the "learn," "see," "practice," and "prove" steps given that NRP remains a model that focuses on education in the "classroom."

Learn of LSPPDM

The "learn" component is a cognitive phase that focuses on learners acquiring the knowledge needed to perform