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VOLUME 8 — ISSUE 10: TRANSCRIPT

Featured Cases: Simulation & Training

Our Guest Author is Dr. Janine Bullard, Assistant Professor, Division of Neonatology at the Johns Hopkins Children's Center in Baltimore, Maryland.

After participating in this activity, the participant will demonstrate the ability to:

- Identify key aspects of planning a simulation scenario for practicing healthcare professionals,
- Describe the features of team debriefing and feedback after simulation performances, and
- Discuss some of the learning models used in simulation-based medical education.

This discussion, offered as a downloadable audio file and companion transcript, covers the important issues related to Simulation and Training in the format of case-study scenarios for the clinical practice. This program is a follow up to the Volume 8, Issue 9 eNeonatal Review newsletter—Simulation and Training.

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MEET THE AUTHOR

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Faculty Disclosure
Janine Bullard, MD has disclosed no relevant financial relationships with commercial supporters.

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Next Month's topic: Neonatal Abstinence Syndrome

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MR. BOB BUSKER: Welcome to this *eNeonatal Review*™ Podcast.

eNeonatal Review is presented by the Johns Hopkins University School of Medicine, and the Institute for Johns Hopkins Nursing. This program is supported by an educational grant from Ikaria and Abbott Nutrition.

Today's program is a companion piece to our Volume 8, Issue 9 eNeonatal Review newsletter: Simulation and Training.

Our guest is that issue's author, Dr. Janine Bullard from the Johns Hopkins Children's Center.

This activity has been developed for physicians, nurses, and respiratory therapists caring for neonates. There are no fees or prerequisites for this activity.

The Accreditation and Credit Designation Statements can be found at the end of this podcast. For additional information about accreditation, Hopkins policies, and expiration dates, and to take the post-test to receive credit online, please go to our website newsletter archive – www.eneonatalreview.org — and click on the Issue 10 podcast link.

Learning objectives are, that after participating in this activity, participants will demonstrate the ability to:

- Identify key aspects of planning a simulation scenario for practicing health-care professionals,
- Describe the features of team debriefing and feedback after simulation performances, and
- Discuss some of the learning models used in simulation-based medical education.

I'm **BOB BUSKER**, managing editor of eNeonatal Review. On the line we have with us Dr. Janine Bullard, Assistant Professor in the Division of Neonatology at the Johns Hopkins Children's Center in Baltimore.

Dr. Bullard has no relevant relationships with commercial supporters to disclose, and her presentation today will NOT include discussion of off-label or unapproved uses any drugs or products.

Dr. Bullard, welcome to this eNeonatal Review Podcast.

DR. JANINE BULLARD: Thank you. It's great to be here.

MR. BUSKER: In the newsletter issue you described some of the evidence that evaluated the use of medical education simulation on performance quality and patient outcomes. What I'd like to do today is look at some examples of simulations. So if you would, Doctor.

DR. BULLARD: Sure. Here's my first example. A neonatal resuscitation team is called to attend the simulated delivery at a community hospital of a 3 kg male infant born by a scheduled repeat C-section at 38 weeks' gestational age. All members of the neonatal resuscitation team are required to attend a half-day workshop each year that includes participating in three simulated-patient scenarios like this one.

The team spends 10 minutes responding to a high-fidelity infant mannequin that appears limp, apneic, and cyanotic and has an initial palpable umbilical cord pulse of 80.

MR. BUSKER: Let me start out with sort of a general question. The educational theory behind the whole idea of medical simulation — tell us about that, if you would.

DR. BULLARD: There really is no specific simulation learning theory; however, simulation does benefit from some broader, general learning theories. One of the most dominant ones is simulation teaching. It's called the experiential learning theory. David Kolb is a main proponent of this and first wrote about its relationship to medical simulation in 1984. He describes that the experiential learning process, called ELP, is a process whereby knowledge is created through the transformation of experience.[1] And then the knowledge results from a combination of grasping and transforming this experience.

It is divided into a four-stage learning model in which immediate or concrete experiences are the basis for observation and reflection. These reflections are then assimilated and distilled into abstract concepts and generalizations from which new implications for actions can be drawn. These implications then can be

actively tested and can serve as guides in creating new experiences.

This learning cycle can be entered at any point.

Another learning theory that is frequently applied to medical simulation is the adult learning theory. The field of adult learning was pioneered by Malcolm Knowles, who believes that the adult learner brings life experiences to learning, incorporating and complementing the cognitive abilities learned earlier in life.[2]

Knowles has five general principles. The first is that adults are autonomous and self-directed, meaning that learning moves from dependency as we see in children, to more autonomy as adults.

Second, adults have accumulated a foundation of life experiences and knowledge that frequently includes work-related activities, family responsibilities, and other knowledge that becomes a resource or a foundation for learning. They need to connect what they're learning now to this knowledge or experience base.

Third, adults are also goal-oriented. Educational programs must be organized with clearly defined elements that help them attain those goals.

Fourth, adults are relevancy-oriented. They must understand the reason for learning something. While children gain knowledge for some postponed objective, adults want to learn something that has immediate implications and an immediate application.

And fifth, adults are practical. Their learning shifts from something that is subject-centered more to something that's problem-centered.

That sums up the two main learning theories associated with simulation.

MR. BUSKER: I just want to make a quick note to our listeners that links to publications Dr. Bullard refers to in our discussion can be found in the transcript version of this podcast.

Now, Dr. Bullard, in the simulation scenario you presented, would you describe for us some of the features in that that can lead to effective learning?

DR. BULLARD: Yes. McGaghie and colleagues wrote about the best- evidence practices for high-fidelity simulation in an article they published last year, and I think this case highlights several of those best features.[3] The first ones are to provide feedback during the learning experience; it's very important for learners to go back through what they have just done and get feedback from various sources.

Also, a simulation must use a deliberate practice to shape, refine, and maintain knowledge, skills, and attitudes. You must also integrate simulated events into other, larger educational events that are planned, scheduled, and required. You must clearly define outcomes and benchmarks for the learners, match educational goals with appropriate simulation tools and technology, and prioritize clinical skill acquisition and the maintenance of those skills. This includes the skills themselves, as well as attributes of professionalism, such as teamwork behavior.

You must also ensure that all learners accomplish the educational goals with little outcome variation. Also, the generalizability of the skills they have learned must pertain to the clinical settings that they practice in.

Finally, provide team training.

Of these 12 characteristics, this scenario used deliberate practice; it integrated simulation into an already planned educational curriculum, prioritized clinical skill acquisition, used team training, provided feedback, and matched fidelity with the actual educational goals.

MR. BUSKER: You just used the term "fidelity," and in the newsletter you talked about high-fidelity and low-fidelity scenarios. What does "fidelity" mean? And please define for us what the various types of fidelity are.

DR. BULLARD: Oh, sure. Maran and Glavin defined fidelity in 2003,[4] as the extent to which the appearance and behavior of a simulator or simulation matched the appearance and behavior of the simulated system. They broke fidelity down into three categories: equipment, task, and environment, and how true each of these categories is to the reality that providers work in. Fidelity will aid in how psychologically true the learners will feel and react to the simulation.

Typically, low-fidelity simulators are focused on single skills and permit learners to practice in isolation. Examples of this might include role-playing or specific-task trainers, such as a model of an umbilical cord.

Medium-fidelity simulators provide a more realistic representation, but lack sufficient keys for learning. But they do allow the learner to become immersed in the situation.

High-fidelity simulators are lifelike mannequins connected to computer systems that control physiologic and physical responses. They respond and change according to the learner's treatment interventions. In a real sense they come to life: they talk to the learners, they represent true physiology with visual, physical, and auditory cues.

MR. BUSKER: Would you give us a scenario that illustrates a high- fidelity simulation.

DR. BULLARD: A neonatal resuscitation team consisting of a neonatal fellow, pediatric resident, neonatal nurse, and neonatal respiratory therapist completed a simulation exercise. They attended the delivery of a 3 kg female infant born by C-section at 39 weeks' gestational age. Before the delivery, the neonatal team was informed that labor had been progressing without complications until about 20 minutes ago, when the mother developed severe abdominal pain.

The team was then shown a series of fetal heart tracings that demonstrated a loss of viability and a drop in baseline heart rate. The team had two minutes to prepare for the arrival of the infant, who was a high-fidelity newborn mannequin covered in simulated blood. All physical cues, including heart rate, respiratory effort, pulse oximetry, tone, color, and a palpable umbilical pulse could be assessed on the mannequin and accompanying pulse oximeter monitor.

The mannequin responded with changes in vital signs based on resuscitation efforts that included invasive and noninvasive ventilation, chest compressions, and epinephrine volume administration through a cannulated umbilical cord on the mannequin. And experienced programmer altered the mannequin's vital signs in response to observed actions and objective measurements available on the computer software.

MR. BUSKER: How would an instructor begin planning this type of a simulation experience?

DR. BULLARD: To start planning for a simulation experience, an educator should first complete a needs assessment for the target learners. Needs assessment is what your learners need to work on, be it knowledge, technical skills, or behavior. It's important to know who the learners are so you can push them to the edge of their practice skills.

Using this case as an example, the learners here are the typical members of the resuscitation team in a teaching hospital's NICU and have varying levels of delivery room experience. The overall educational objective was to give the team a planned experience of a rare event in the delivery room. It is really not cost-effective to use simulation to teach purely factual knowledge or skills, so this scenario was created to teach the application of NRP knowledge to an infrequent clinical situation and to work on both individual skills and team behaviors.

After determining the needs of your target audience, specific learning objectives should be outlined before creating a scenario. These objectives can be broken down into technical, cognitive, and behavioral categories. In this scenario, the overall goal for the team was to anticipate the needs of a neonate and perform the stabilization required of a neonate born with an acute placental abruption.

Technically, the team was to gather equipment necessary to stabilize the infant with an anticipated hypovolemia, perform initial steps of neonatal resuscitation, prepare and place an emergency UV line, prepare and administer appropriate medication and fluid, and notify the blood bank of any urgent blood products.

Cognitive objectives were to understand normal and abnormal parameters and fetal heart tracings, understand the basic steps of neonatal resuscitation using NRP guidelines, recognize clinical signs and symptoms of an acute placental abruption, perform an acute assessment during the neonatal resuscitation, prioritize patient needs during the resuscitation, and maybe even discuss initiation of passive body cooling for an asphyxiated infant. Behavioral objectives were to work cohesively as a team and communicate vital information to one another throughout the resuscitation.

After an educator determines the objectives for the target audience, a plot should be created. Really, the best plots are those that are derived from actual experiences or real cases and organized around items that have been targeted for improvement based on QI data.

MR. BUSKER: Once you've established a framework of what you want to accomplish, what's the next step? How do you set up the simulation scenario?

DR. BULLARD: The guiding principle is to make the experience as real as possible for the learners. There are many challenges inherent in attempting to achieve this degree of realism.

In this example, there is a tremendous advantage to using high- fidelity simulation in which the mannequin, itself, can mimic real physical findings and real physiologic responses to the actions of the team. Unfortunately, the cost and limited availability of high-fidelity simulators makes it impractical to use them in all areas of medical training.

So to try to maximize the value and potential of high-fidelity simulations, educators should try to match the degree of realism desired with the educational objectives for each of the simulation sessions. Certainly, you could use other low-fidelity devices such as static mannequins and specific task trainers to accomplish smaller objectives, or if you are limited to a smaller budget.

For a simulation like this one, where a high degree of realism is desired, the primary goal of the educator should be to suspend disbelief. This terminology, suspend disbelief, is used a lot in simulation, and what it means is, to try to get learners to immerse themselves completely into the experience so that they believe and feel as though they are actually in a real situation.

In essence, they suspend disbelief that it is a simulation or practice session. The learners then would be committed to being fully engaged in their learning and to the actual scenario.

MR. BUSKER: Talk to us a little more, if you would, about suspending disbelief. What are some of the things the scenario designer can use to more fully engage the learners?

DR. BULLARD: Careful attention should be paid to the room design. To the best of your ability, the room should match what the resuscitation area looks like in the actual hospital. In this example, the room was recreated to look like an actual delivery room. It is also important to attempt to use the same equipment that is familiar to the team members. The equipment, such as a radiant warmer, airway equipment, umbilical lines, and a code cart should be similar to what is typically used. It will detract from the realism of the experience if the equipment is different. It can also affect the team's performance and confidence.

Unfortunately, it isn't always feasible to use the same equipment. If you're designing a simulation in such a situation, the group should be oriented to the space and instructed how to use any unfamiliar equipment before starting the simulation.

Some other obvious but often-forgotten details will also provide more realism. You should provide other kinds of resources that would be typical in a delivery room such as gowns, gloves, blankets, delivery room phones or pages, how the team would arrive in a delivery, as well as alcohol hand solution.

There is actually some room for artistic fun when trying to enhance the realness of a scenario. In this case, the baby was covered in simulated blood. Using these kinds of artistic creations in simulation is called "moulage."

Moulage may be as simple as a visual clue like applying pre-made rubber or latex to create wounds or defects, such as an omphalocele or gastrochisis to the abdomen, or moulage could invoke senses such as smell. Sometimes people have gotten pretty creative in devising recipes to simulate different types of wounds or smells that might be similar to what you would encounter with chorioamnionitis.

Moulage is a tool that can be used to help learners look for physical signs that would either support a diagnosis or lead them to find other physical findings on the mannequin. When used appropriately in simulation, moulage will increase knowledge and performance by increasing learners' response time, enhancing evaluation of the clues that are there, supporting the learners' critical thinking as they go through the process, adding to realism, engaging all of their physical senses, and aiding in suspending their disbelief.

MR. BUSKER: What's the basic procedure to design the progression of this type of scenario?

DR. BULLARD: First you have to create a script for how you want the scenario to start, and then what changes will happen with either appropriate or inappropriate maneuvers of the team. Depending on what type of simulation device is being used, this may be programmed into the software ahead of time, or it may be done on the fly during the resuscitation.

It is important to define specifically what critical action should occur during the simulation. These actions are a series of steps that must be done successfully to demonstrate understanding of your predefined objectives, then breaking each task down into the smallest identifiable action is necessary to direct how the scenario will progress. A checklist of these items should be created. As the team performs or fails to perform these critical steps, the scenario will move along different paths.

The checklist can also help organize feedback to the group and really standardize the experience for subsequent learners with the same scenario. Being cognizant of what pitfalls or common mistakes people can make should also be built into the checklist. You can, in fact, load the scenario to reinforce the potential for common mistakes. This can be actually a pretty effective learning tool.

As an example, with this case, say the educator wanted to underscore the importance of team behavior and the use of check- backs during medication administration. To accomplish this, the nurse in the scenario could have a scripted role that would be called a confederate. This means the nurse is not a learner, but is planted in the scenario. The nurse could hand the wrong medication dose to the team leader and announce the wrong dose. Then how the group handles the mistake, either by identifying and correcting the mistake or not, can help make the point about the importance of check-backs in team behavior.

MR. BUSKER: And we'll return in a moment with Dr. Janine Bullard from Johns Hopkins Children's Center.

DR. CHRISTOPH LEHMANN: Hello, I'm Dr. Chris Lehmann. I'm the Director for Clinical Information Technology at the Children's Medical and Surgical Center at Johns Hopkins and one of the Program Directors for eNeonatal Review.

eNeonatal Review is a CME-accredited program presented by The Johns Hopkins University School of Medicine. eNeonatal Review has two parts: a newsletter delivered by email and podcasts, like the one you are currently listening to. Each presents current, concise, peer-reviewed literature reviews and commentary in areas of importance to neonatologists, NICU nurses, and respiratory therapists working with neonatal patients. Ten thousand of your colleagues have already registered for eNeonatal review. Please join them.

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For more information on registration to receive eNeonatal Review without charge, or to look at archived issues, please go to www.eneonatalreview.org. Thank you.

MR. BUSKER: Welcome back to our eNeonatal Review podcast. I'm Bob Busker, managing editor of the program. Our topic is Simulation and Training. And our guest is Dr. Janine Bullard from the Johns Hopkins Hospital Children's Center.

We've been discussing some of the parameters that can help make a simulation a successful learning experience. One of the elements I'd like us to focus on a little more is learner feedback. So if you'd start us out with a scenario, Dr. Bullard.

DR. BULLARD: An interdisciplinary group of learners has just completed a simulation exercise as part of recertification for NRP. The activity was organized by a local NRP instructor who had access to a medium-fidelity simulator for the program. The instructor used a stationary audio-video camera to record the resuscitation of a 4.2 kg male infant born with thick meconium-stained fluids at 41-3/7 weeks' gestational age. The team begins to debrief with the NRP instructor.

MR. BUSKER: Talk to us, if you would, about what the NRP instructor wants to accomplish with this group during the feedback.

DR. BULLARD: To be complete, a simulation needs to be more than just the experience. Debriefing after a simulation experience gives the chance for reflection on actions. This is actually where the learning occurs. It is the most critical and most variable part of this simulation-based medical education.

Feedback can be broken down into three categories: variety, source, and impact. The variety, or type, of feedback is either formative or summative. The purpose of formative feedback is to improve performance, whereas summative feedback is a judgment, like a pass/fail of this scenario.

In 2008, Rudolph described a four-step model of formative feedback that is grounded in evidence and theory from education research.[5] The steps are to note salient performance gaps related to any predetermined objectives, provide feedback describing those gaps, investigate the basis for the gaps by exploring the frames and emotions that contributed to that performance level or to what those gaps were, and help close those performance gaps through discussion or targeted instruction about the principles and skills relative to that performance.

The second category of feedback is sources, and those can come either from the trained facilitator; the simulation device; video or digital recording, such as the audiovisual recording in this scenario; and from the group itself. Each of these sources has limits, and typically, using a combination of them is likely to produce the greatest educational result.

The impact of feedback is how the simulation experience and the process of debriefing affected subsequent clinical behavior. As an area of research, there's still a lot of questions remaining about specific feedback methods. For example, what model and dose of feedback are needed for a particular outcome? Do some methods prove more efficient, require fewer resources, and give longer- lasting effects? Last, feedback standards and guidelines have to be developed so that instructor competence can be measured.

MR. BUSKER: Again, just a reminder to our listeners, links to the publications Dr. Bullard refers to can be found in the transcript version of this podcast.

Dr. Bullard, it sounds like there are no real standards for the NRP instructor to use during the feedback sessions. So in the absence of standards, what are some good general practice tips for the instructor to remember during debriefing?

DR. BULLARD: Salas and colleagues listed 12 evidence-based best practices for debriefing in an article derived from a review of current literature published in the Joint Commission of Journal and Quality in Patient Safety in 2008.[6]

First, debriefing must be diagnostic of the performances. It must be a critical review of what was done during the simulation. There must be a supportive learning environment during the debrief. Team leaders and team members must be attentive to teamwork processes during the performance episodes.

The team leaders must be educated on the art and science of actually leading team debriefs. It is important that all the members feel comfortable during the debrief and pick a few critical performance issues to focus on during the debriefing process. Specific teamwork interactions and processes must also be addressed during the team's performance.

Feedback must be supported with objective indicators of the performance so you can indicate, as an example, the appropriate use of chest compressions to ventilation ratio and NRP. You must provide outcome feedback later and less frequently than actually was the process this team went through. You must provide both individual and team-oriented feedback and know which one to use and when each is appropriate.

You should shorten as much as possible the delay between when the team performed the scenario and the when you give feedback, meaning that you should do the debriefings immediately after each simulation.

Last, you must record any kind of conclusions or goals that the group set during the debriefing process.

There are some other effective-practice suggestions. You should set the expectation that each learner is participating in the debriefing session. You should guide the session to the extent necessary to achieve the objectives of the simulation, and you may have to adjust the facilitation to a level that will engage learners to the maximum extent.

It's important to try to draw out any quiet learners and ensure that all critical points are covered. It's also important to integrate instructional points needed for any kind of learning discussion. And certainly you want to reinforce positive aspects of the learning behavior. You really want to avoid having lecturing or debriefing become centered around the instructor. You want to avoid giving your own analysis and evaluation of the simulation before the learners have had an opportunity to do so.

You don't want to convey the attitude that your perception is what's most important. You should try to avoid interrupting or interrogating. You should be positive about discussing the problems. And certainly, you don't want to shortchange any of these learning sessions by cutting the session short.

MR. BUSKER: So the instructor wants to encourage a discussion that reflects the key cognitive, technical, and behavioral objectives of the scenario. Get specific for us here, if you would. What are some of the specific questions the instructor might ask to facilitate that kind of discussion?

DR. BULLARD: In a recent continuing education article from the December 2010, issue of the Journal of Perinatal and Neonatal Nursing, the authors give a nice summary of how to facilitate a reflective discussion for NRP using simulation-based learning.[7]

That article suggested making sure the cognitive, technical, behavioral objectives are well outlined. For cognitive objectives, typically you want the group to know how to assess a neonate and have knowledge of the NRP algorithm.

So questions that you might use would be, what concerned you about this neonate at birth? What are the fundamental initial steps of neonatal resuscitation? And what key indicators are you looking for to guide your resuscitation?

Technical objectives may address how the group handled ventilations and compressions. To elicit feedback with technical objectives, you could ask, how do you assess the effectiveness of bag mask ventilation? How can you tell whether the neonate is successfully intubated? And how well were the ventilations and compressions coordinated?

Finally, behavior objectives: you want the group to anticipate and plan for a crisis and work together as a team. To address some of these concerns, you could ask how effective was communication among the team members? What helped or hindered providing care to the neonate? Was enough information given during the handoff? Who was the actual leader? And was any critical information missed by team members?

MR. BUSKER: The time that's allotted for debriefing: what should the NRP instructor do to most effectively and efficiently organize it?

DR. BULLARD: In general, the debriefing should be about three times longer than the scenario, because debriefing, again, is where the real learning occurs. The instructor is in charge of the time frame and ensuring that all the learning objectives and any unanticipated events are reviewed.

Debriefing should begin within 5 minutes of the conclusion of the scenario. Again, you don't want a lot of time to lapse between the scenario and reflection on the actual performance. If the simulation is videotaped, you should play key segments that are important for discussion of the learning objectives. Usually you should start showing videotaping by about 2 to 3 minutes into the debriefing process.

And again, you want to use open-ended questions. So your ratio of open-ended to just yes/no questions should be high, and your goal should be to have about 2 or 3 responses for each open-ended question from the learners during the debriefing.

MR. BUSKER: One final question, Dr. Bullard. Look into the future for us, if you would. What do you see happening in terms of simulation as a learning medium for neonatal specialists?

DR. BULLARD: Over the past 20 years or so, simulation has gained a lot of popularity for health care provider training because of its successes in other industries with high risk and no margin for error, for example, airlines and the military.

Simulation in neonates has been used to fulfill these needs by improving patient safety, teaching integrative approaches to problems, standardizing educational curriculum, teaching decision-making, practicing working in teams, and planning experiences of rare events.

MR. BUSKER: Dr. Jeannine Bullard from the Johns Hopkins Children's Center, thank you for participating in this eNeonatal Review podcast.

DR. BULLARD: l thank you for this opportunity. I've really enjoyed it. Thank you.

MR. BUSKER: This podcast is presented in conjunction with the eNeonatal Review Newsletter, a peer-reviewed, CME/CE-accredited literature review e-mailed monthly to clinicians caring for neonates.

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Thank you for listening.

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