Journal of Neonatal Nursing (2014) **20**, 283—289

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Jnn

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Simulation training for surfactant replacement therapy: Implications for clinical practice

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Available online 24 May 2014

KEYWORDS
Simulation;
Surfactant;
NICU;
Collaboration

Abstract The fragile infant in the neonatal intensive care unit (NICU) requires unique and specialized care. Complications and long-term outcomes related to respiratory distress are dependent upon early assessment and intervention from the healthcare team. Surfactant replacement therapy (SRT) is the standard of care for most premature and term infants experiencing respiratory distress. However, treatment is often omitted or delayed due to clinician variability, inadequate medication ordering and dispensing, or because personnel are unfamiliar with procedure expectations. High-fidelity simulation may be used as a training technique to eliminate these variances: reviewing indications, outcomes and objectives, practicing professional roles during emergencies, and addressing policy and procedure issues. In addition, simulation is an effective tool for improving team dynamics, which can lead to quicker treatment and better patient outcomes. Therefore, all NICU staff responsible for administering or assisting with SRT should participate in SRT high-fidelity simulation and demonstrate competency, prior to attending any delivery. Debriefing post-simulation assists in identifying positive and negative behaviors, and it is used to determine if any changes in practice or system operation are required. Simulation, as an interdisciplinary and emergency training tool, is essential for the success of NICU responders administering surfactant replacement therapy and the long-term outcomes of the newborn infant in distress.

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http://dx.doi.org/10.1016/j.jnn.2014.04.002

Simulation is a tool that has been used by many professions to improve safety. Hospitals and nursing schools have incorporated simulation as a means of experiencing and applying theory "in a safe environment where mistakes can be made without risk to patients" (Billings & Halstead, 2009, p. 323). Demands for increased competency, error reduction and improved patient care, growth in healthcare demands, a shortage of clinical sites, and advancements in technology, have all increased the necessity of simulation in nursing education (Beauchesne, 2011). Simulation is a learning strategy that has been around for many years. It was first used "as a means of teaching psychomotor skills and physical assessment" (Beauchesne, 2011, p.28), as early as 1911. Today's simulations can include low-fidelity equipment (best used for foundational skills), a high-fidelity mannequin (more complex, realistic and interactive) or an actor (standardized patient that interacts with student learner), with or without additional equipment as part of a scenario (Billings & Halstead, 2009; Jeffries, 2012). Simulation is increasingly becoming the preferred method for reviewing clinical abilities such as skill development and teamwork. In fact, it is commonly used in the NICU to practice SRT administration and build teamwork skills on infants in times of premature delivery or during respiratory distress.

Review of literature

Surfactant replacement therapy

Surfactant is a compound found between the alveolar surfaces and gas, in the lungs. During exhalation, surfactant-deficient alveoli do not inflate properly and may cause the lung to collapse completely, or it may require great force to expand. Premature infants are often surfactant-deficient and have an increased risk of respiratory distress syndrome (RDS); a condition associated with an increase in morbidity and mortality (Walsh et al., 2013). Sittlington, Tubman, and Halliday noted that RDS contributes to nearly "32% of all deaths in the first week of life" (1991, p. 20). Therefore, premature infants are given surfactant replacement therapy (SRT) for immature lung development or to prevent RDS, within 30 min of birth, or as a rescue treatment 2–12 h after birth. Although commonly used for infants less than 34 weeks gestation, it is most effective in infants under "30 weeks gestation and/or with birth weights of less than 1250 g and more often in male infants" (Engle, 2008, p. 420; Sittlington et al., 1991; Walsh et al., 2013). Surfactant administration requires special training for prompt identification of need and proper endotracheal tube (ETT) delivery (Walsh et al., 2013). These infants may also require oxygen, with continuous positive airway pressure (CPAP) or mechanical ventilation. Yet, early research has found that: (1) SRT decreases the need for oxygen, and (2) infants getting SRT have a greater overall survival rate than infants receiving only ventilation (Sittlington et al., 1991). Most significantly, SRT has been shown to be safe, with no affect on "neurologic, developmental, behavioral, medical, or educational outcomes in preterm infants" (Engle, 2008, p.426).

Simulation and teamwork

When developing simulations for patient safety, "scenarios are designed to create experiences that reflect high-risk, low-volume situations that demand meticulous, timely intervention" (Kuehster & Hall, 2010, p.124). These simulations are also designed to encourage shared responsibility and reflection, while practicing emergency situations and teamwork (Billings & Halstead, 2009; Kuehster & Hall, 2010). Teamwork is defined as, "behaviors that facilitate effective interaction among team members" (Smith & Cole, 2009, p. 165). Communication, a component of teamwork, is included among the Joint Commission's Patient Safety Goals. It is a leading cause of errors/events, accounting for as much as "two thirds of sentinel events reported to the Joint Commission" (Smith & Cole, 2009, p.164). When communication skills are practiced, they are more likely to be used in a participant's clinical environment (Kuehster & Hall, 2010). A positive atmosphere and the use of open-ended questions are also recommended because they "promote a nonjudgmental atmosphere conducive to sharing" (Rudolph et al., 2006, p. 28). Other components of teamwork include understanding roles and responsibilities, knowing limitations, knowledge sharing, constructive intervention, reevaluation and summarizing (Chameides et al., 2011). Peckler et al., 2012 indicate that active learning such as role-playing and simulation are more effective than traditional didactic lessons alone, for improving teamwork. Situation-based team training has been shown to be effective for improving teamwork skills (Augenstein et al., 2010; Guise et al., 2010; Hamman et al., 2010).

Although there is a "need for interdisciplinary teams to collaborate and coordinate their care to achieve a common goal (improved patient outcomes)" (Smith & Cole, 2009, p.165), the complexity of the NICU environment may be a