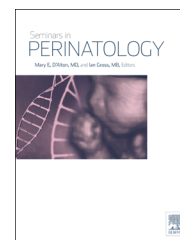


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## Neonatal outreach simulation

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## ABSTRACT

Numerous factors contribute to neonatal morbidity and mortality, and inexperienced providers managing crisis situations is one major cause. Simulation-based medical education is an excellent modality to employ in community hospitals to help refine and refresh resuscitation skills of providers who infrequently encounter neonatal emergencies. Mounting evidence suggests that simulation-based education improves patient outcomes. Academic health centers have the potential to improve neonatal outcomes through collaborations with community hospital providers, sharing expertise in neonatal resuscitation and simulation. Community outreach programs using simulation have been successfully initiated in North America. Two examples of programs are described here, including the models for curricular development, required resources, limitations, and benefits. Considerations for initiating outreach simulation programs are discussed. In the future, research demonstrating improved neonatal outcomes using outreach simulation will be important for personnel conducting outreach programs. Neonatal outreach simulation is a promising educational endeavor that may ultimately prove important in decreasing neonatal morbidity and mortality.

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### Introduction

In developing countries, the majority of perinatal and neonatal mortalities and morbidities occur in the home. The causes are multifactorial and include low-socioeconomic status, lack of knowledge, or access to health care, including referral systems for emergency obstetric care and transportation to appropriate facilities.<sup>1</sup> In developed countries, evidence suggests that morbidity and mortality rates increase for newborns whose mothers live greater than 20 min by car

to a hospital, who are born in a hospital greater than 60 miles (100 km) from a level III Neonatal Intensive Care Unit (NICU), or who are born in hospitals with a low number of total births per year such as in smaller rural hospitals.<sup>2-4</sup> In these communities, health care professionals have fewer opportunities to practice the knowledge and skills necessary for neonatal resuscitation, leading to skill decay.<sup>5,6</sup>

The majority of complications in developing countries could be prevented with early detection and appropriate management by applying the requisite knowledge, skills,

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and behaviors.<sup>7,8</sup> Reduction in neonatal mortality in these areas of the world is possible through community-based interventions.<sup>9</sup> “Helping Babies Breathe,” a collaborative program between the American Academy of Pediatrics (AAP), the World Health Organization, and the US Agency for International Development, is one example of an initiative that teaches neonatal resuscitation skills in resource-limited areas.<sup>10</sup> There is evidence across many medical settings that community partnerships with academic health centers (AHCs) or other large organizations (such as the AAP or state/provincial and local public health departments) can result in greater involvement in quality improvement efforts and improved medical care.<sup>11,12</sup>

Outreach programs from AHCs to community hospitals have the potential to be tremendously beneficial in reducing neonatal morbidities and mortality. Particularly, *in situ* simulation, which allows for inter-professional training in actual patient care units where care is delivered, may be of great value.<sup>13</sup> There is evidence that training provided in the community hospital, an *in situ* setting, might be more effective than the routine training offered during Pediatric Advanced Life Support (PALS) or Neonatal Resuscitation Program (NRP) courses.<sup>14</sup> Training medical staff members to recognize developing critical illness is crucial and simulation training can be an important tool.<sup>15,16</sup> There are established programs to help recognize critically ill neonates such as Acute Care of At-Risk Newborns (ACoRN) and S.T.A.B.L.E., but these are workshops that are not designed as longitudinal outreach programs. There is mounting evidence demonstrating improvement in team behaviors during emergency resuscitations in areas including trauma centers,<sup>17</sup> pediatric dental clinics,<sup>18</sup> and other ambulatory settings<sup>19</sup> following outreach simulation education. However, there is few published literature on improvements in neonatal morbidities and mortality with outreach simulation education. An exception is an Australian study examining outcomes of 127,753 infants following multi-professional outreach obstetric training that demonstrated improved 5-min Apgar scores, although there were no significant improvements in rates of stillbirth, perinatal death, and moderate or severe hypoxic-ischemic encephalopathy.<sup>20</sup>

Neonatal outreach simulation (NOS) here refers to educational programs offered from AHCs to community medical providers utilizing simulation-based medical education (SBME). SBME incorporates adult learning theory, realistic resuscitation scenarios, and constructive debriefings. In NOS, realism is enhanced through use of an *in situ* environment. NOS programs offer services to populations of health care providers who might not otherwise have access to, the financial resources for, or the expertise in simulation education. Cook et al.<sup>21</sup> found that, when compared with no intervention or when used in combination with traditional practices, simulation has large beneficial effects on knowledge, process skills, and product skills. In addition, provider confidence improved and there were moderate effects on patient-related outcomes. A 2015 literature review of the impact of SBME described benefits in patient outcomes after training for obstetric emergencies.<sup>22</sup>

In addition to improving patient outcomes, simulation plays a vital role in the identification of latent safety threats

(LSTs) at academic centers.<sup>23–25</sup> LSTs can be thought of as errors in the design, organization, or maintenance of systems that might contribute to medical errors.<sup>26</sup> Similarly, LSTs can be successfully identified and corrected with AHC community partners using simulation.<sup>27,28</sup>

Most studies describing the effects of simulation are conducted in academic centers with trainees. Similarly, in published descriptions of mobile and distributed simulation, trainees are the primary participants.<sup>29,30</sup> This article serves to describe two diverse community-based NOS programs, both targeting postgraduate medical providers in community hospital settings. The programs originate in Indianapolis, Indiana, USA, and Vancouver, British Columbia, Canada. We will describe limitations of current educational offerings seeking to train community health care providers in emergency neonatal care. In addition, goals of NOS, methods of providing NOS, and financing and sustaining NOS programs will be described. Finally, potential benefits and limitations of this educational modality will be discussed, including the importance of outcomes data.

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## Two North American programs

### Program in Indiana, USA

In 2009, SBME had not been widely used for continuing medical education, despite it being considered an effective and powerful tool in this area.<sup>31</sup> At this time there was a thriving young simulation program in neonatal resuscitation being conducted at the AHC in the Section of Neonatal-Perinatal Medicine at the Indiana University (IU) School of Medicine. The program was expanding into other subspecialty areas in pediatrics and exploring collaborations with obstetric partners. Simulation leadership began to consider the need to expand simulation outside the AHC and utilized the Kern Model for Curriculum Development to explore this possibility.<sup>32</sup>

### Problem identification

Verbal reports from neonatal transport team personnel identified resuscitation barriers and lack of current experience of community hospital resuscitation teams, including delivery room (DR) management errors or delays. Also, community partners were requesting refresher courses in DR resuscitation, including recent residency graduates who understood the benefits of SBME through their previous training.

During this time period, Indiana University Health (IU Health), the large healthcare system partner of IU School of Medicine and Riley Hospital for Children were looking for new opportunities to fulfill their educational mission in the state. Additionally, they sought strategies to strengthen relationships with community hospitals in Indiana.

At that time, the educational approach with community partners for DR resuscitation consisted of didactic courses, NRP renewal, NRP Hospital-Based Instructor and Regional Trainer Courses, and S.T.A.B.L.E. courses. In addition, telephone consultation was available 24/7 to community providers who found themselves in a crisis situation. These approaches were not ideal in meeting the needs of

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