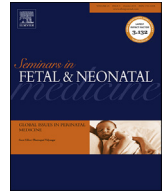




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Review

From the Neonatal Resuscitation Program to Helping Babies Breathe: Global impact of educational programs in neonatal resuscitation



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S U M M A R Y

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Two educational programs in neonatal resuscitation, the Neonatal Resuscitation Program (NRP) and Helping Babies Breathe (HBB) have found widespread acceptance globally as practical tools to improve newborn survival and reduce death from perinatal asphyxia. The programs share a common scientific evidence base and both employ adult education principles with an emphasis on building skills. However, they differ in their target audience and context, their core content, and the methods used for knowledge translation. This review describes how the design of NRP transported it outside the USA to countries around the globe and how the program has contributed to improvements in care at multiple levels from the bedside to guidelines and research. It examines the gaps in the reach of NRP that stimulated the development of HBB and helped shape a different approach to education of health care providers in resource-limited settings. Implementation of HBB is summarized to date, and evidence provided of its effectiveness in reducing neonatal death and stillbirth. Finally, consideration of how the programs function together suggests their future potential to strengthen health systems and maximize the impact on the health of newborns.

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1. Introduction

The birth of a baby represents one of the most dramatic physiologic transitions in human life. Although this transition most often proceeds naturally and smoothly, the day of birth also carries high risk of death when the transition is disrupted. Neonatal resuscitation, broadly defined as support for successful transition at birth, thus has been a major focus in all efforts to improve neonatal survival. Even in technologically advanced settings, the now-accepted standard of having a person skilled in neonatal resuscitation at every birth took decades to become reality. In resource-limited settings this reality has not yet been achieved. Two educational programs for health care providers, the Neonatal Resuscitation Program (NRP) and Helping Babies Breathe (HBB), have played a central role in the evolution toward the global goal of having a skilled person present at the birth of every baby.

2. Global implementation of the Neonatal Resuscitation Program

2.1. Elements promoting transportability

Development of NRP came in response to the emergence of neonatal intensive care in the 1970s. At that time, rates of neonatal mortality from asphyxia (intrapartum-related events) and prematurity were unacceptably high in the USA; there was increasing awareness that community hospitals needed to recognize and provide initial management of infants who required care in a neonatal intensive care unit. The National Institutes of Health funded five projects to provide education on the fundamentals of neonatal care to first-level hospitals in the USA. One of the responses was an educational program which focused on training health professionals in neonatal resuscitation. Leadership from the American Academy of Pediatrics and the American Heart Association worked together with the program's developers, Ronald Bloom, MD, and Catherine Cropley, RN, MSN, of Drew Postgraduate Medical School, to shape the program for dissemination through the Section on Perinatal Pediatrics of the American Academy of Pediatrics (AAP) [1].

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The design of NRP deliberately standardized the approach to resuscitation, based it upon the best evidence currently available, and conveyed not only knowledge but the skills necessary to care for infants at birth. These elements became the keys to the program's transportability and rapid uptake outside the USA. The organization of the NRP algorithm linked progression through the resuscitation steps to repeated evaluation/decision/action cycles centered on responses of the baby. Although initially based on consensus of experts, the content of NRP progressively incorporated the rigorous evidence evaluation of the International Liaison Committee on Resuscitation (ILCOR). After 2000, the program incorporated revisions every five years on the same cycle as publication of the ILCOR Consensus on Science and Treatment Recommendations and the American Heart Association Guidelines for Neonatal Resuscitation [2,3]. The self-instructional format and performance checklists put an emphasis on active learning and performance of skills from the beginning of the program. This represented a very different style of learning for continuing medical education in the USA, and the innovative approach added to the appeal of the program globally.

2.2. Dissemination through professional associations

The demand for use of NRP outside the USA began shortly after the program's introduction in 1987. NRP was designed to be straightforward enough that it could be implemented in any hospital in the USA. Pediatricians who had been exposed to NRP workshops in the USA carried the program to hospitals in their own countries and spread it through their own pediatric associations. The first course outside North America was conducted in India in 1989 [1]. Health systems in Latin America, Europe, and South Africa were facing similar challenges in reducing neonatal mortality and morbidity, and early in the 1990s requests came steadily to the American Academy of Pediatrics for permission to use the educational materials and collaborate with USA faculty to begin train-the-trainer cascades abroad. Fig. 1 summarizes the rapid increase in the number of countries where NRP was taught through the 1990s and early 2000s [1]. Dissemination concentrated in countries that were developing and refining hospital-based systems of care for mothers and newborns. In many countries, dissemination remained limited to a region or an organization. However, in several countries the national pediatric association or neonatology society worked together with the ministry of health to develop a training plan. Interdisciplinary trainings included nurses, midwives and other perinatal professionals (anesthetists, obstetricians, technicians), but stressed completion of skills consistent with responsibilities. Ownership, structure, and operation of training programs rested fully with the implementing country; an in-country administrative body recognized instructors, conducted courses, awarded course completion cards, and tracked the number of providers trained.

2.3. Evidence of effectiveness and impact of NRP

Early evidence of the global effectiveness of NRP came from a number of ad-hoc institutional studies showing improvement in outcomes ranging from provider knowledge, skills, and performance to demonstrated reduction in neonatal mortality. In India, the introduction of NRP resulted in improved recognition of newborns requiring resuscitation, as well as improved adherence to correct resuscitation technique. After training in 14 teaching hospitals, providers increased the use of bag and mask ventilation and intubation, with accompanying decrease in use of chest compressions and medications. This change in practice correlated with decreased asphyxia-specific mortality [4]. Implementation of NRP

in a single large metropolitan hospital in China resulted in a decrease in early all-cause neonatal mortality [5]. The educational approach was found to be useful and successful with a wide variety of perinatal providers, including physicians, nurses, midwives, and medical assistants [6–9]. The program showed utility in pre-service settings and residency training as well as in-service education [4,10,11]. However, studies of educational effectiveness in the USA and other countries also consistently reported a time-related decay in skills performance and need for periodic refresher training [12].

As NRP initiatives in many regions of the world matured, they provided an organizing principle for the development of strong national newborn programs that achieved reductions in perinatal and neonatal mortality. NRP provided a focal point for collaboration between professional associations of pediatricians and neonatologists and ministries of health [13,14]. Initiatives often began with comprehensive training in a target region or throughout the public health system. Implementation of NRP in Malaysia during an eight-year period, with training of nearly 15,000 health personnel, was associated with a progressive decrease in perinatal and neonatal mortality rates [6]. Many programs identified additional initiatives beyond resuscitation training; for example, Costa Rica developed neonatal transport services and accelerated uptake of antenatal steroids and surfactant, which were then new therapies [15]. In some cases, the focus on neonatal resuscitation stimulated important changes in governmental policy. The Chinese Ministry of Health and Centers for Disease Control introduced NRP training nationwide in 2005. Resulting changes in policy permitted midwives to initiate resuscitation and required resuscitation training for licensure. Follow-up from 322 hospitals in 20 target provinces demonstrated a decrease in deaths in the delivery room from 7.5 to 3.4 per 10,000 live births from 2003 to 2008 and a decrease in the incidence of Apgar <7 at 1 min from 6.3 to 2.9% [16]. In many countries, NRP has stimulated an increase in research around neonatal resuscitation. As an outgrowth of the Brazilian Neonatal Resuscitation Program (Box 1), active monitoring of asphyxia-related deaths is carried out nationwide, aimed at identifying and addressing causes and disparities. Ultimately, global participation in NRP has led to enrichment of the community of resuscitation science. Representatives from many countries of all seven regional resuscitation councils now participate in neonatal ILCOR evidence evaluation. Their contributions to the ILCOR Consensus on Science help build the evidence base for regional resuscitation council guidelines and the NRP itself.

3. Evolution of the approach to neonatal resuscitation: the origins of HBB

Nearly twenty years after the introduction of NRP, it became evident that a different approach was needed to address the global burden of neonatal mortality. In the year 2000 the United Nations General Assembly ratified the Millennium Development Goals (MDGs), aimed at reducing poverty globally. Among these, MDGs 4 and 5 dealt with reducing under-five child mortality and maternal mortality. MDG 4 focused the world's attention on just how large a proportion of under-five child deaths occurred in the neonatal period. Whereas early steep declines occurred in mortality rates for older infants and children, rates of neonatal mortality remained relatively flat. By the mid-2000s deaths in the first 28 days of life were the single largest cause of death for children aged less than five years, accounting for 40% or more of total deaths [17]. Furthermore, 98% of the estimated four million newborn deaths per year occurred in low- and middle-income countries [18]. Analysis of the causes of death showed that asphyxia, low birth weight/prematurity, and infection consistently accounted for the largest proportion of deaths [19]. Examination of the timing of death

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