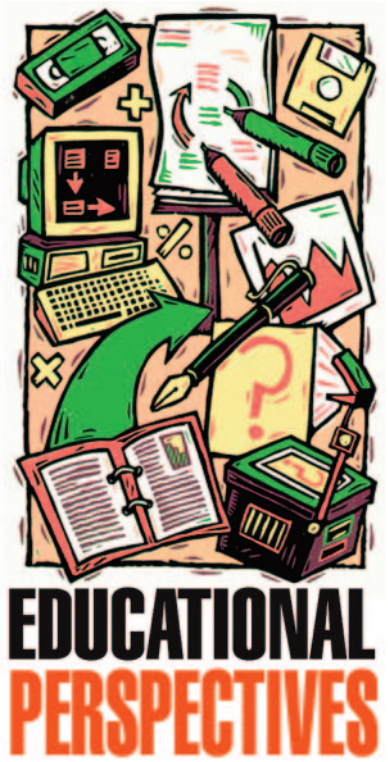
Educational Perspectives: The Genesis, Adaptation, and Evolution of the Neonatal Resuscitation Program

Louis P. Halamek

NeoReviews 2008;9;e142-e149
DOI: 10.1542/neo.9-4-e142



The Genesis, Adaptation, and Evolution of the Neonatal Resuscitation Program

Louis P. Halamek, MD*

Abstract

For more than 2 decades, the Neonatal Resuscitation Program (NRP) of the American Academy of Pediatrics (AAP) has set a national standard and international example for training in the resuscitation of the newborn. The concept of a standardized approach to neonatal resuscitation, based on the best available evidence, was revolutionary in 1987 when the NRP was officially launched. Because the NRP continues to adapt, it remains one of the most successful educational interventions in health care. This article describes its genesis, continuing adaptation, and prospects for evolution in the next decade.

Author Disclosure

Dr Halamek did not disclose any financial relationships relevant to this article.

Genesis

"To emphasize that in every area where a delivery might occur (delivery room, emergency department, etc.,) there be at least one person available who has acquired the basic and/or advanced resuscitation skills." (1)

As the subspecialty of neonatology grew in the 1960s and 1970s and neonatal intensive care units sprang up in hospitals across the United States, health-care professionals working in these units recognized the need to develop a consistent approach to caring for neonates transitioning from an intrauterine to an extrauterine existence. In the 1980s, the Committee on the Fetus and Newborn and the Section of Perinatal Pediatrics of the AAP made training in neonatal resuscitation a national priority and established the Resuscitation of the Newborn Task Force led by George Peckham, MD (Table 1). This task force set a goal of having at least one professional trained in neonatal resuscitation at every delivery in the country. They built on the work of Ronald Bloom, MD, and Catherine Cropley, RN, MN, who, while working at the Drew Postgraduate Medical School in Los Angeles, received a grant from the National Institutes of Health to create the Neonatal Education Program (NEP) that subsequently served as the basis for the NRP. Errol Alden, MD, then Director of Education at the AAP, spearheaded the establishment of a formal relationship with Leon Chameides, MD, John Raye, MD, and others at the American Heart Association (AHA) and other national organizations (Table 2) to facilitate expert review of the contents of the NRP and develop a strategy for its dissemination throughout the country. After extensive discussion, planning, and preparation, NRP was officially launched in 1987.

From the very first program, it was clear that the NRP would need to be

*Division of Neonatal and Developmental Medicine, Department of Pediatrics, Stanford University, Palo Alto, Calif.

Table 1. Original Members of the Resuscitation of the Newborn Task Force

Ronald Bloom, MD
Frederic Burg, MD
Gregory Carroll, PhD
William Fox, MD
Charles Gibbs, MD
George Peckham, MD
Alan Schwartz, MD
Kit Stahler, MD
William Taeusch, MD

sufficiently flexible to adapt readily to the changing needs of a diverse population of trainees. Key guiding principles built into the program included:

1) *Base practice recommendations on the best available evidence.* Although many aspects of neonatal resuscitation are based on rational conjecture because of the paucity of available data, those guiding the development of the NRP always have striven to achieve consensus among experts in the field regarding clinical practice recommendations. Informal at first, this process has become international in scope through the International Liaison Committee on Resuscitation (ILCOR).

Table 2. Founding Members of the NRP

Errol Alden, MD
Ronald Bloom, MD
David Burchfield, MD
Leon Chameides, MD
Catherine Cropley, RN, MN
John Kattwinkel, MD
William Keenan, MD
George Peckham, MD
John Raye, MD

2) *Recognize the different types of skills necessary for successful neonatal resuscitation.* The various professionals caring for the newborn in the delivery room have different levels of responsibility and, therefore, must possess different skill sets. The modular nature of the NEP, which was focused on specific content knowledge and hands-on skills, was carried over in development of the NRP, which has allowed the NRP to adapt to the specific needs of individual trainees yet remain relevant to the entire resuscitation team.

3) *Understand the importance of self-education for the adult learner.* Another unique aspect of the training methodology used in NRP is its self-instructional design. Although the clinical experience of the instructors is recognized as a valuable resource for trainees, the NRP is designed so that groups or individuals may benefit from its content and trainees can use the materials during independent study to prepare for group training activities.

4) *Adequately prepare instructors.* Heavy emphasis initially was placed on establishing groups of highly trained, geographically distributed instructors. These national and regional instructors trained additional instructors, who delivered NRP to the many professionals at healthcare facilities throughout the country. Formal training materials for NRP instructors were developed to facilitate this process.

5) *Regionalize training.* The system whereby national instructors taught regional instructors, who then trained hospital-based instructors, allowed the NRP to be rolled out in a controlled and efficient manner. Not limiting instructors to a specific facility or training center allows them to deliver NRP to trainees throughout their region, not just at their local institution.

Since its inception in 1987, the NRP has enjoyed tremendous success. More than 2,200,000 trainees have experienced NRP, as taught by more than 27,000 instructors in the United States alone. NRP training materials have been well received and have won several awards for innovative contributions to healthcare education and training. The NRP provider manual has been translated into 25 languages, and NRP has been taught in 124 different countries around the world. The acceptance of NRP has been so profound that the program serves as a cornerstone of the international efforts of the AAP. In fact, the AAP's Office of International Affairs is headed by William Keenan, MD, one of the founders of the NRP, who was named a "Giant of Resuscitation" by ILCOR and the AHA in 2005. (2)

Adaptation

Despite 2 decades of resounding success, the NRP has had to adapt continually to stay relevant and provide an optimal learning experience for its trainees. One of the most obvious examples of this adaptation lies in the regular re-evaluation of the clinical guidelines adopted by the NRP. Despite regional and national differences in the approach to neonatal resuscitation, it has been recognized that newborns around the world exhibit many similar pathophysiologies. ILCOR began an effort in 1992 to address the need for closer international collaboration on issues involving neonatal, pediatric, and adult cardiopulmonary resuscitation and emergency cardiovascular care. (3) It is comprised of various delegations (neonatal, pediatric, adult) representing the AHA, the Heart and Stroke Foundation of Canada,

the Inter American Heart Foundation, the European Resuscitation Council, the Australian and New Zealand Committee on Resuscitation, and the Resuscitation Councils of Southern Africa. (4) Every 5 years, the neonatal delegation identifies important questions pertinent to newborn resuscitation, reviews the available evidence, reaches consensus as to the best evidence-based answers to these questions, and posts this review online. (5) Groups such as the Steering Committee of the NRP then generate nation- and region-specific guidelines for clinical care based on this review of the science and publish these in major peer-reviewed journals. (6)

Of course, the mission of the NRP is not limited to simply disseminating clinical guidelines; it also provides the learning tools to facilitate acquisition of not only the content knowledge but also the technical skills required to implement the clinical guidelines. The debut of NRP in 1987 represented the first time that clinical guidelines had been listed, vetted, and delivered in a coherent, efficient, and effective manner on a national scale. Since that time, under the leadership of the NRP Steering Committee, the program has continued to be on the cutting edge of professional education and training. A number of innovative educational tools were released in its most recent iteration (2005), including:

- *The Textbook of Neonatal Resuscitation*. 5th ed
- *Textbook of Neonatal Resuscitation Multimedia* CDROM
- *Cases in Neonatal Resuscitation* DVD
- *Ethics and Care at the End of Life: Involving Parents in Ethical Decision Making* DVD

The textbook contains a wealth of content information and is liberally illustrated with line drawings and photos. (7) The CDROM accompanying the textbook contains a large number of illustrations, photographs, and videos that map to specific chapters in the textbook. Such multimedia elements create a much more immersive learning experience for trainees by allowing them to manipulate images almost as they would real physical objects. The DVD containing cases in neonatal resuscitation allows the trainee to enter a clinical scenario, choose a course of action from a list of possible interventions, and witness the results of his or her choices; each choice is followed by feedback from an on-screen virtual mentor during a short debriefing. The final DVD depicts a difficult ethical situation, that of impending delivery of a preterm neonate at the limits of viability in a community hospital, and draws the trainee into the scenario via a series of "teachable moments." In sum, these materials provide a rich source of content that can be used to enhance the learning opportunities of both individuals and groups.

Content knowledge can be assessed by completion of an online examination that can be taken at the trainee's convenience. This demands that trainees assume responsibility for their own education; they no longer can expect instructors to "spoon feed" didactic material to them in just the right amount to allow them to complete the written examination successfully. By raising the expectations placed on trainees for thorough advance preparation (as documented by successful completion of the online examination), instructors can use their time with trainees to provide learning opportunities that are much richer and more interactive than lectures and proctored written examinations.

Table 3. Key Behavioral Skills

1) Know your environment.
2) Anticipate and plan.
3) Assume the leadership role.
4) Communicate effectively.
5) Delegate workload optimally.
6) Allocate attention wisely.
7) Use all available information.
8) Use all available resources.
9) Call for help when needed.
10) Maintain professional behavior.

Historically, the emphasis of NRP has been on assimilation of content knowledge and demonstration of the technical skills necessary for neonatal resuscitation. Yet, content knowledge and technical skills alone are insufficient for the delivery of optimal care while working as a team under intense time pressure. Behavioral skills, such as effective communication, teamwork, and leadership, also are critically important during crises such as resuscitation of the newborn, yet little attention has been paid to training methodologies that facilitate acquisition of such skills (Table 3). The Joint Commission published a *Sentinel Event Alert* in 2004 that found ineffective communication to play a role in almost 75% of the cases of neonatal mortality or severe neonatal morbidity reported to that agency. (8) It subsequently recommended that all health-care organizations responsible for delivering newborns establish a system of training that incorporates behavioral skills such as teamwork and effective communication and regularly conduct clinical drills followed by constructive debriefings. The NRP has begun to address the importance of behavioral skills and other ele-

ments of crew resource management strategy (first developed by the commercial aviation industry in an effort to improve safety) by incorporating some of these concepts into the learning objectives of the NRP. (9)(10)(11)

All of these developments point to a new emphasis on learning (and the adult learner) rather than teaching (and the teacher). Realization that not everything that is taught necessarily is learned is ending the days of "death by Powerpoint" in which instructors unfamiliar with the material simply read what is on the slides and move on to the next exercise. An appreciation for the tenets of adult learning is producing more interactive, intellectually stimulating environments in which the instructor functions to facilitate rather than dominate the learning process. (12)

Keeping instructors informed of recent developments is a mandatory component of the NRP. To facilitate communication with its 27,000 instructors, the NRP publishes a semiannual *NRP Instructor Update* that is downloadable from the NRP's website. (13) This is complemented by the opportunity to interact with NRP Steering Committee members at the NRP Current Issues Seminar held annually immediately prior to the AAP's National Conference and Exhibition. Each seminar is developed around a central theme deemed timely for instructors, and summaries of recent basic science and clinical medicine topics pertinent to neonatal resuscitation are presented. Breakout sessions allow instructors to focus on topics of special interest. All of the presentations (in PDF) are available on the NRP website for downloading.

Another novel and very successful aspect of the NRP is the NRP Grant Program. (14) Since its initiation in 1994, it has funded more than 35 studies conducted by investigators from the United States and other countries. Both established and new ("Young Investigator") researchers are encouraged to apply. This mechanism has proven very effective for stimulating research in areas deemed to be of high priority to the community of clinicians and investigators interested in resuscitation of the newborn.

New Challenges

Despite tremendous efforts to generate evidence-based clinical guidelines, gaps remain in knowledge of the physiology and treatment of the patient in need of resuscitation. The Pediatric Advanced Life Support (PALS) program of the AHA provides training in advanced cardiac life support for children. It, too, has gained wide acceptance in the United States as the standard for pediatric (non-neonatal) resuscitation. The NRP recommends a compression-to-breath ratio of 3 compressions to 1 breath for all newborns (in the presence of single or multiple rescuers), but the PALS program recommends a ratio of 30:2 for all patients, except newborns, when a single rescuer is present. (15)(16)(17) Thus, the questions arise: How does one define what constitutes a newborn, and when should health-care professionals follow NRP guidelines and when should they follow PALS guidelines? It is likely that the degree of granularity of the supporting data never will be sufficient to produce a precise answer (especially given the difficulty in conducting prospective, randomized, controlled clinical trials in neonatal and pediatric resuscitation), and anyone wishing for an answer that has an absolute cutoff (involving both gestational and chronologic ages) is likely to be disappointed. Similar uncertainties exist regarding the relative utility of endotracheal intubation versus the laryngeal mask airway and emergency umbilical venous cannulation versus intraosseous access. However, consensus may be possible to achieve, if based only on rational conjecture, as to how to proceed. For example, it makes sense to consider not just the patient's gestational and chronologic ages, but also the underlying pathophysiology when deciding what resuscitation guidelines to follow in particular clinical situations. This means that health-care professionals caring for growing preterm infants, sick term infants undergoing prolonged hospitalization, and patients in the first postnatal weeks presenting in extremis to emergency departments and clinics require accurate diagnostic skills and familiarity with a range of potential therapies. This is likely to be an active area of basic science and clinical investigation in the years to come. In the meantime, health-care professionals need to exercise their best judgment when faced with situations for which clear clinical guidelines do not exist.

Historically, trainees and instructors alike have expected some percentage of face-to-face time during the training program to be dedicated to didactic instruction for content knowledge to be "passed" from instructor to trainee. This expectation is not in line with adult education theory that emphasizes active participation by trainees. Despite efforts by the NRP Steering Committee to recommend limiting the time spent in passive exercises such as lecture, data presented at the 2007 NRP Seminar by Gary Weiner, MD, confirm that many instructors continue to devote an inordinate amount of time to lecturing. (18) Results of a national survey of NRP instructors indicate that most spend the greatest percentage of time in a NRP provider course using slides to lecture on the content

information *already included* in the NRP provider manual. This same group of instructors, when asked to rate the effectiveness of various learning methodologies, indicated that they felt lectures were relatively *ineffective*. To create a more interactive and productive learning experience, the responsibility for acquisition of content knowledge must shift from the instructor to the trainee, and time spent in lecture (reviewing material that theoretically already should have been mastered by trainees) will need to be de-emphasized further or eliminated entirely.

Successful completion of NRP provider training requires achieving the minimum passing score on a multiple-choice written examination of content knowledge and demonstration of pertinent technical or procedural skills on task trainers while being observed by an instructor. The text on the NRP provider card given to those completing the program states that the holder of the card "has successfully completed the national cognitive and skills evaluations indicated on the reverse side in accordance with the curriculum of the American Academy of Pediatrics/American Heart Association Neonatal Resuscitation Program." The *Textbook of Neonatal Resuscitation* states, "Completion of the program does not imply that an individual has the competence to perform neonatal resuscitation. Each hospital is responsible for determining the level of competence and qualifications required for someone to assume clinical responsibility for neonatal resuscitation." (19) Nowhere does material issued by the NRP claim that an individual who has successfully completed the program is competent to resuscitate real newborns at the time of delivery. Despite the cautionary stance taken by the NRP and the AAP, it is common to hear or see the words "certified in NRP" or "NRP-certified" used in reference to successful completion of the NRP by individuals outside of the NRP Steering Committee and its staff and liaisons. Although no one argues that participation in a well-run NRP training session is harmful, certainly there is potential harm in interpreting possession of a course completion card as indicative of competence in the real delivery room. The NRP never was intended to be used as a measure of the competence of health-care professionals (especially those already experienced in neonatal resuscitation); rather, it was developed to facilitate acquisition of the elemental content knowledge and technical skills necessary to resuscitate a newborn. In the absence of data indicating that professionals experiencing the NRP perform at a higher level when caring for real patients when compared with non-NRP-trained individuals (and also that the patients cared for by such professionals have better outcomes), the relationship between successful completion of the NRP and trainee competence remains hypothetical. Better delineation of this relationship requires the development of more realistic training scenarios and reliable performance metrics.

Many hospitals in the United States have policies mandating successful completion of the NRP and possession of an active NRP provider card as a condition for employment for any health-care professional bearing responsibility for the direct care of newborns. This is certainly laudable, but creates a paradox: To remain in compliance with their own policies and facilitate participation by what may be hundreds of staff in NRP on a biennial basis, hospitals often must limit severely the time allotted for training so that all staff may take (and pass) the written test and demonstrate technical skills to an instructor. This focus on compliance rather than achievement of learning objectives by trainees is misplaced and diminishes the value of the training.

Evolution

The NRP will continue to evolve, both in content and in process, to meet the needs of the professionals looking to it for support. Development of a career-long learning program in neonatal resuscitation that is relevant to professionals from multiple disciplines at all levels of experience and is embedded with robust learning opportunities and valid performance metrics is the focus of the NRP. Accomplishing this requires a change in the very culture of health-care education and training. Elements of this culture change necessarily include:

- Extending evidence-based practice to education and training practices and adopting strategies that follow from adult learning theory.
- Transitioning the role of teacher to that of a facilitator of learning and empowering the learner to take control of his or her own education.
- Moving from a model of sporadic or intermittent "bolus" training to one that facilitates learning on a continuous basis throughout a career.
- Embracing high-fidelity, high-stakes simulation-based training as the standard in preparation for and assessment of performance in the real environment.
- Encouraging development of challenging training experiences and expecting and accepting failure during these experiences so trainees may learn from their mistakes.
- Focusing on staff competency rather than regulatory compliance.

Reviewing available evidence and reaching international consensus under the auspices of ILCOR continues to be an effective method of generating guidelines for clinical care, and this methodology soon will be extended to guidelines for education and training. It is anticipated that education and training guidelines addressing the optimal methods for facilitation and assessment of learning will be published in 2010 alongside clinical guidelines as part of the ILCOR process.

The stage is being set for a major shift in learning methodology within the NRP. This shift alters the role of an instructor from someone who *imparts* knowledge and skill *to* the trainees to one who *facilitates* acquisition of such knowledge and skills *by* the trainees. Such a shift demands that trainees play an active role in assuming responsibility for their progress and that instructors cede control of the learning process to the trainees. The Instructor Development Task Force began meeting in early 2007 to plan how to prepare NRP instructors for this major shift and create the learning materials that will be required to support instructors in their new role.

Participation in NRP currently is recommended on a biennial basis as a single isolated training experience. Renewal of NRP provider status (commonly and incorrectly referred to as "recertification") typically is a single experience consisting of several hours of training that involves the NRP written examination, technical skills stations, and a "megacode" in which trainees are required to integrate all of their knowledge and skills. The NRP Steering Committee recognizes that even though a single training experience once every 2 years facilitates compliance with institutional policies, it often is not consistent with achieving optimal educational outcomes. Thus, the NRP is poised to transition to a career-long learning model in which trainees are required to review different aspects of neonatal resuscitation regularly using an assortment of learning methodologies. This requires development of new learning materials, many of which will be accessible online from anywhere in the world where internet access is available. Such availability will allow rapid updating of content to reflect new evidence, embedding many more visual and auditory cues into training materials to stimulate learning, and creating a large database of challenging interactive case-based learning modules, replete with references, that will prove valuable to even the most experienced of delivery room professionals.

Simulation-based training, where trainees are immersed in highly realistic re-creations of actual real-life clinical events, will play a major role in the evolution of NRP. This type of training has been used successfully for decades in a number of other industries where the risk to human life is high. Although relatively new to the health-care field in general, work has been ongoing in simulation-based training in neonatal resuscitation at the Center for Advanced Pediatric & Perinatal Education at Packard Children's Hospital at Stanford for more than 10 years, and this effort and others have led to a number of methodologic and technologic innovations that will transform training in neonatal resuscitation radically. (20)(21) Such hands-on, practical training can be conducted either in the real clinical environment or physical space equipped to replicate the real environment with a high level of fidelity.

Mastery of the technical skills required for successful resuscitation of the newborn requires not only an understanding of when those skills should be used but also the ability to interpret visual, auditory, and tactile cues to perform the appropriate manual tasks in the correct sequence. Although technical skills may improve with increasing clinical activity in the real delivery room caring for real patients, it is also possible (and preferable) to acquire and maintain such skills on suitable models (human patient simulators). Such models need to possess a level of fidelity similar enough to a real human newborn that the important cues are presented accurately to the trainee, allowing achievement of learning objectives. To date, most human neonatal models have had a low level of anatomic fidelity and little or no ability to represent the physiologic alterations intrinsic to the neonate in distress. To stimulate interest in development of a realistic human neonatal patient simulator, a list of characteristics was drawn up and vetted by the NRP Steering Committee and published online in 2005 as a request for proposals (RFP) to industry. This was a seminal moment in patient simulator history, marking the first time that development of a highly realistic patient simulator was driven by the learning objectives put forth by a professional body rather than by the internal marketing imperatives of industry. This RFP now functions as an open invitation to industry that should guide initiatives in this field for years to come and provide NRP trainees and instructors with tools to facilitate the acquisition and refinement of the cognitive, technical, and behavioral skills necessary for successful resuscitation of the newborn.

Achieving high scores on examinations of knowledge and skill long has been expected of health-care professionals. Indeed, successful completion of the NRP requires achieving a minimum passing score on a

multiple-choice written examination and successfully performing various technical skills, such as bag-mask ventilation and chest compressions, while under the watchful gaze of an instructor. Failure, when it occurs, is seen uniformly as a negative experience and results in embarrassment at best and denigration and denial of a NRP provider card at worst. Thus, trainees often are guided by instructors, not being allowed to deviate in the slightest from the path deemed most appropriate by the instructors, that they may "learn." Yet how does learning occur? It may be argued that we learn best from our mistakes. As human beings, we often make mistakes, especially when operating in high-stakes situations under intense time pressure. If those mistakes occur when caring for patients, they may carry lifelong consequences for those patients. In episode 6, Mare Tranquilitatis, of the HBO television miniseries "From the Earth to the Moon," Neil Armstrong (played by actor Tony Goldwyn) and crewmate Buzz Aldrin (actor Bryan Cranston) prepare to land on the moon for the first time in human history. This was obviously a high-stakes endeavor because failure not only would have engendered national embarrassment at missing John Kennedy's vow to place a man on the moon by 1970 but also could have cost the astronauts their lives. During one particularly challenging training exercise in the lunar module simulator, the astronauts failed to abort the landing and crashed the simulator into the artificial moon's surface. During the debriefing that follows, it is obvious that egos were bruised and anger bubbles to the surface. Despite all of this, it is during a quiet moment after the simulator session and debriefing that Neil Armstrong turns to Buzz Aldrin and states simply, "Sims (simulations) are for learning." The training model used in aerospace is radically different from that historically used in health care. The underlying assumption in aerospace is that things WILL go wrong and crews must know how to handle every contingency. Thus, those responsible for training astronauts design programs that encompass every possible failure so the crews have the opportunity to practice solving particular problems prior to encountering them in actual spaceflight. The expectation is that failure will occur during training and that the professionals undergoing such training will learn from their failures and not repeat them during future training missions or actual spaceflight. Compare this to training in health care where success, not failure, is the focus. By not pushing trainees to fail in difficult training scenarios, they may leave training with a false sense of confidence and are set up to fail when working in the real clinical environment.

Summary

The NRP has set the standard for training in neonatal resuscitation for more than 2 decades. Part of this success is attributable to its ability to adapt to the ever-changing needs of its instructors and trainees. The next decade will bring even more substantial methodologic and technologic innovations as the NRP becomes more learner-focused and learner-friendly and embraces methodologies such as simulation and technologies such as online libraries of interactive case-based scenarios. This continuing evolution of NRP should make it even more useful to the practicing neonatologist as a source of continuing medical education and career-long learning.

ACKNOWLEDGMENTS. The author acknowledges the kind contribution of the following individuals to the material included in this work: John Kattwinkel, MD, Bill Keenan, MD, Susan Niermeyer, MD, George Peckham, MD, Wendy Simon, MA.

References

1. Summary notes. Goals. Resuscitation of the Newborn Task Force. September 25–26, 1980. Courtesy of George J Peckham, MD
2. Keenen named resuscitation giant. *NRP Instructor Update*. 2005;14(1):2. Available at: http:www.aap.org/nrp/newsletter/2005_springsummer_iu.pdf
3. Chamberlain D. The International Liaison Committee on Resuscitation (ILCOR)-past and present. Compiled by the founding members of the International Liaison Committee on Resuscitation. *Resuscitation*. 2005;67:157–161
4. *Your Guide to the 2005 International CoSTR Conference*. Dallas, Tex: American Heart Association; 2005. Available at: http://www.c2005.org/presenter.jhtml?identifier=3022536
5. *C2005 Evidence Evaluation Worksheets: International Liaison Committee on Resuscitation 2005 Consensus on ECC & CPR Science and Treatment Recommendations*. Dallas, Tex: American Heart Association; 2005. Available at: http://www.c2005.org/presenter.jhtml?identifier=3026177
6. From the 2005 International Consensus Conference on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations, hosted by the American Heart Association in Dallas, Texas, January 23–30, 2005. Section 1. Part 7: Neonatal resuscitation. *Circulation*. 2005;112(suppl 1):III-91–III-99. Available at: http://circ.ahajournals.org/cgi/content/full/112/22_suppl/III-91
7. Kattwinkel J, ed. *Textbook of Neonatal Resuscitation*. 5th ed. Elk Grove Village, Ill and Dallas, Tex: American Academy of Pediatrics and American Heart Association; 2006
8. The Joint Commission. Preventing infant death and injury during delivery. *Sentinel Event Alert*. 2004;30. Available at: http://www.jointcommission.org/SentinelEvents/SentinelEventAlert/sea_30.htm
9. Helmreich RL, Wilhelm JA, Gregorich SE, Chidester TR. Preliminary results from the evaluation of cockpit resource management training: performance ratings of flightcrews. *Aviat Space Environ Med*. 1990;61:576–579
10. Helmreich RL, Chidester TR, Foushee

HC, Gregorich S, Wilhelm JA. How effective is cockpit resource management training? Exploring issues in evaluating the impact of programs to enhance crew coordination. *Flight Saf Dig*. 1990;9:1–17

11. Zaichkin J, ed. Optional activities. In: *Instructor's Manual for Neonatal Resuscitation*. 5th ed. Elk Grove Village, Ill, Dallas, Tex: American Academy of Pediatrics and American Heart Association; 2006:chapt 8

12. Zaichkin J, ed. Educational foundations of the Neonatal Resuscitation Program. In: *Instructor's Manual for Neonatal Resuscitation*. 5th ed. Elk Grove Village, Ill, Dallas, Tex: American Academy of Pediatrics and American Heart Association. 2006: chapt 1

13. Neonatal Resuscitation Program Web site. Available at: http://www.aap.org/nrp/nrpmain.html

14. *2008 Sponsored Research Grant Program and Young Investigator Award Application and Guidelines*. Available at: http://www.aap.org/nrp/science/science_grant.html

15. 2005 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Part 13: Neonatal resuscitation guidelines. *Circulation*. 2005;112:IV-188–IV-195

16. 2005 American Heart Association Guidelines for Cardipulmonary Resuscitation and Emergency Cardiovascular Care. Part 1: Introduction. *Circulation*. 2005; 112:IV-1–IV-5

17. 2005 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Part 11: Pediatric basic life support. *Circulation*. 2005;112:IV-156–IV-166

18. Weiner G. *NRP 2007: What It Is and Isn't, What Works and Doesn't*. Presented at American Academy of Pediatrics National Conference and Exhibition. Available at: http://www.aap.org/nrp/pdf/NRPToday.pdf

19. Kattwinkel J, ed. Neonatal Resuscitation Program provider course overview. In: *Textbook of Neonatal Resuscitation*. 5th ed. Elk Grove Village, Ill, and Dallas, Tex: American Academy of Pediatrics and American Heart Association; 2006:ix

20. Halamek LP, Kaegi DM, Gaba DM, et al. Time for a new paradigm in pediatric medical education: teaching neonatal resuscitation in a simulated delivery room environment. *Pediatrics*. 2000;106:e45. Available at: http://www.pediatrics.org/cgi/content/full/106/4/e45

21. *A New Vision for Pediatrics and Perinatal Education*. Palo Alto, Calif: Center for Advanced Pediatric & Perinatal Education. Available at: http://www.cape.lpch.org

Educational Perspectives: The Genesis, Adaptation, and Evolution of the Neonatal Resuscitation Program

Louis P. Halamek

NeoReviews 2008;9;e142-e149
DOI: 10.1542/neo.9-4-e142