Updates for the Neonatal Resuscitation Program and Resuscitation Guidelines

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PRACTICE GAP

Updated treatment guidelines for neonatal resuscitation need to be applied to clinical practice.

OBJECTIVES *After completing this article, readers should be able to:*

1. Explain the process of developing neonatal resuscitation guidelines and educational materials.
2. Summarize the steps included in the Neonatal Resuscitation Program treatment algorithm.
3. Discuss 6 practice changes included in the Neonatal Resuscitation Program, 8th edition.
4. Describe 6 ventilation corrective steps that may improve the effectiveness of positive pressure ventilation in the newborn.

AUTHOR DISCLOSURES Ms Zaichkin is the Associate editor of the *Textbook of Neonatal Resuscitation*. Dr Weiner is the Editor in chief of the *Textbook of Neonatal Resuscitation*. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.

ABBREVIATIONS

AAP	American Academy of Pediatrics
AHA	American Heart Association
CoSTRs	Consensus on Science with Treatment Recommendations
CPAP	continuous positive airway pressure
ETT	endotracheal tube
HR	heart rate
ILCOR	International Liaison Committee on Resuscitation
PPV	positive pressure ventilation
RQI	Resuscitation Quality Improvement

ABSTRACT

Although most newborns require no assistance to successfully transition to extrauterine life, the large number of births each year and limited ability to predict which newborns will need assistance means that skilled clinicians must be prepared to respond quickly and efficiently for every birth. A successful outcome is dependent on a rapid response from skilled staff who have mastered the cognitive, technical, and behavioral skills of neonatal resuscitation. Since its release in 1987, over 4.5 million clinicians have been trained by the American Heart Association and American Academy of Pediatrics Neonatal Resuscitation Program®. The guidelines used to develop this program were updated in 2020 and the *Textbook of Neonatal Resuscitation,* 8th edition, was released in June 2021. The updated guidelines have not changed the basic approach to neonatal resuscitation, which emphasizes the importance of anticipation, preparation, teamwork, and effective ventilation. Several practices have changed, including the prebirth questions, initial steps, use of electronic cardiac monitors, the initial dose of epinephrine, the flush volume after intravascular epinephrine, and the duration of resuscitation with an absent heart

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rate. In addition, the program has enhanced components of the textbook to improve learning, added new course delivery options, and offers 2 course levels to allow learners to study the material that is most relevant to their role during neonatal resuscitation. This review summarizes the recent changes to the resuscitation guidelines, the textbook, and the Neonatal Resuscitation Program course.

INTRODUCTION

Most neonates born at or near term will initiate breathing shortly after birth either spontaneously or in response to stimulation and drying. Approximately 5% to 7% of term newborns will require positive pressure ventilation (PPV) with a face mask to initiate spontaneous respiratory effort in the delivery room and a smaller number will require advanced resuscitation skills such as tracheal intubation, chest compressions, or emergency epinephrine administration. (1)(2) A successful outcome is dependent on a rapid response from skilled clinicians who have mastered the cognitive, technical, and behavioral skills of neonatal resuscitation.

In 1987, the American Academy of Pediatrics (AAP) and the American Heart Association (AHA) released the first educational program specifically designed to address the resuscitation of newborns immediately after birth. Since that time, the Neonatal Resuscitation Program® (NRP) has become the North American training standard for health care professionals who are responsible for the care of newborns in the hospital setting. (3) The guidelines used to develop the program were updated in 2020 and the 8th edition of the *Textbook of Neonatal Resuscitation* was released in June 2021. (4)(5) This review will summarize the recent changes in the resuscitation guidelines, the textbook, and the NRP course.

GUIDELINE DEVELOPMENT

When the AAP and AHA released the first edition of the NRP textbook, most guidelines were based on current practice, rational conjecture, and expert consensus with little scientific evidence. Since 2000, the evidence supporting resuscitation practices for adults, children, and newborns has been evaluated by the International Liaison Committee on Resuscitation (ILCOR). ILCOR is a multinational collaboration of experts representing resuscitation councils from around the world. The United States is represented on ILCOR by the AHA and members of the NRP Steering Committee who participate on the ILCOR Neonatal Life Support Task Force. Using a rigorous process, the task force evaluates the strength and certainty of evidence for key resuscitation questions and releases a series of consensus statements. These consensus statements are called Consensus on Science with Treatment Recommendations (CoSTRs). The individual CoSTRs are published on the ILCOR website (www.ilcor.org) for public comments, and summaries of multiple statements are published periodically in the journals *Circulation* and *Resuscitation*. (2)(6) Based on local resources, systems of care, and other contextual issues, ILCOR consensus statements are used by member councils to inform their national or regional guidelines. In North America, the CoSTRs are used by the AHA and AAP to develop neonatal resuscitation guidelines. The most recent *AHA Guidelines for Cardiovascular Care and Emergency Cardiac Care: Part 5: Neonatal Resuscitation* were released on October 21, 2020. (4) Finally, the AAP NRP Steering Committee creates the educational materials that support the goal of having a qualified individual who can initiate resuscitation at every birth and a qualified team with full resuscitation skills immediately available for every resuscitation.

THE NEONATAL RESUSCITATION ALGORITHM

In contrast to adult cardiopulmonary resuscitation, establishing effective ventilation remains the focus of neonatal resuscitation. Although a large volume of research has been published since the NRP 7th edition textbook was released, the most recent ILCOR CoSTR summary and AHA guidelines have not changed the basic approach to neonatal resuscitation, and the NRP 8th edition algorithm (Fig 1) is largely unchanged. (5)

- Before birth, the obstetric and newborn care clinicians meet to identify risk factors that increase the likelihood of requiring resuscitation after birth, plan the appropriate team to attend the birth, agree on the plan for umbilical cord management, and perform a standardized equipment check.
- Regardless of the appearance of the amniotic fluid, term newborns who are breathing or crying and have good muscle tone may be placed skin-to-skin with their mothers to complete the initial steps of newborn care, thermal management, and ongoing assessment. Term newborns without respiratory effort or with poor tone and all preterm newborns are brought to a radiant warmer for the initial steps.

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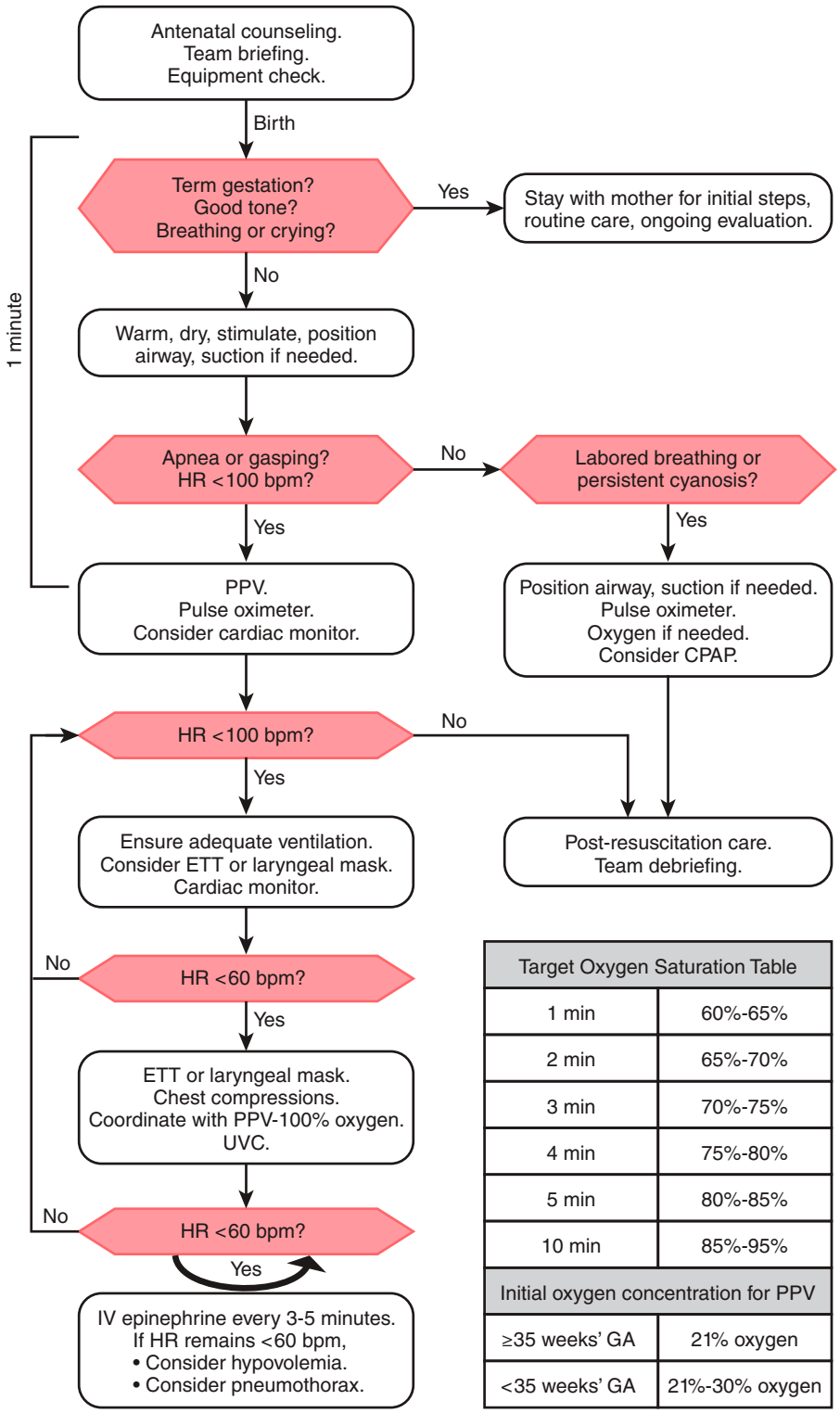

Target Oxygen Saturation Table	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%
Initial oxygen concentration for PPV	
≥35 weeks' GA	21% oxygen
<35 weeks' GA	21%-30% oxygen

Figure 1. Neonatal Resuscitation Program® 8th edition algorithm. CPAP=continuous positive airway pressure, ETT=endotracheal tube, GA=gestational age, HR=heart rate, PPV=positive pressure ventilation, UVC=umbilical venous catheter. (Reprinted with permission from Weiner GM, Zaichkin J. *Textbook of Neonatal Resuscitation*. 8th ed. Itasca, IL: American Academy of Pediatrics; 2021.)

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- After the initial steps, if the newborn's heart rate (HR) is less than 100 beats/min, or if the newborn is apneic or gasping, PPV should be started within the first minute after birth. PPV is initiated with 21% oxygen in term and late preterm newborns (≥35 weeks' gestation) and 21% to 30% oxygen in preterm newborns of less than 35 weeks' gestation. The oxygen concentration used for PPV is adjusted to achieve minute-specific preductal oxygen saturation targets measured using pulse oximetry on the right hand or wrist.
- If the newborn's HR does not rapidly improve and the chest is not moving with PPV, a series of ventilation corrective steps are recommended to address mask leak and airway obstruction and ensure adequate ventilating pressure.
  - The ventilation corrective steps are described in the NRP textbook using the mnemonic MR. SOPA (Table 1). Once chest movement with PPV is achieved, ventilation is continued for 30 seconds, and the HR is reassessed.
  - If the newborn's chest is still not moving after the first 5 ventilation corrective steps, an endotracheal tube (ETT) or laryngeal mask should be inserted to optimize ventilation.
  - Once placement is confirmed, PPV continues for another 30 seconds, and the HR is reassessed. In most cases, the HR will improve after these interventions.
- If the newborn's HR remains less than 60 beats/min despite optimizing ventilation with an alternative airway, chest compressions are started using both thumbs.
  - Chest compressions are always coordinated with PPV in a 3:1 ratio.
  - When compressions are started, the oxygen concentration used for PPV is increased to 100%.
- After 1 minute of coordinated compressions and ventilations, if the HR remains less than 60 beats/min, epinephrine administration, volume expansion, and consideration of other causes of cardiorespiratory failure may be required.
- Throughout neonatal resuscitation, it is essential to maintain attention to ventilation technique, thermal management, and effective teamwork.

NEONATAL RESUSCITATION CLINICAL PRACTICE REVISIONS

Although interim research has largely confirmed previous recommendations and added to the certainty of evidence, several practices have been revised in the NRP 8th edition to improve patient safety and educational efficiency (Table 2).

Prebirth Questions

To improve coordination between the obstetric and newborn care clinicians immediately after birth, the 4 prebirth questions have been revised to include a question about the umbilical cord management plan. For both term and preterm newborns, systematic reviews have confirmed the safety and potential benefits of delayed umbilical cord clamping. (7)(8) In preterm newborns of less than 34 0/7 weeks' gestation who do not require immediate resuscitation, low-to-moderate certainty evidence suggests that deferring cord clamping for at least 30 to 60 seconds after birth improves cardiovascular transition and hematologic measures and may improve survival. (4) Although intact umbilical cord milking may be an alternative for some preterm newborns, it is not recommended for newborns

Table 1. The Ventilation Corrective Steps (MR. SOPA)

Step	Description
MR.	**M**ask adjustment
	Reposition head and neck
	• *Give 5 breaths, check chest movement*
	• *If no chest movement, move to the next step*
SO	**S**uction mouth and nose
	Open mouth
	• *Give 5 breaths, check chest movement*
	• *If no chest movement, move to the next step*
P	**P**ressure increase in 5-10 cm increments (maximum 30-40 cm H_2O)
	• *Give 5 breaths after each increment, check chest movement*
	• *If no chest movement at maximum pressure, move to next step*
A	**A**lternative airway (endotracheal tube or laryngeal mask)
	• *Confirm insertion*
	• *Assess heart rate after 30 seconds of PPV with chest movement*

Adapted from Weiner GM, Zaichkin J. *Textbook of Neonatal Resuscitation*. 8th ed. Itasca, IL: American Academy of Pediatrics; 2021. (5)

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Table 2. Neonatal Resuscitation Program, 8th edition, Practice Changes

Practice Change	NRP 7th Edition	NRP 8th Edition
Umbilical cord management added to prebirth questions	1. Gestational age? 2. Amniotic fluid clear? 3. How many infants? 4. Additional risk factors?	1. Gestational age? 2. Amniotic fluid clear? 3. Additional risk factors? 4. Umbilical cord management plan?
Initial steps reordered	Warm, position airway, clear secretions if needed, dry, stimulate	Warm, dry, stimulate, position airway, suction if needed
Earlier use of electronic cardiac monitor	When chest compressions start	When an alternative airway is needed
Simplified initial dose of epinephrine	IV/IO dose range 0.01–0.03 mg/kg ET dose range 0.05–0.1 mg/kg	Suggested initial dose: IV/IO = 0.02 mg/kg ET = 0.1 mg/kg (while establishing vascular access)
Increased flush volume for intravascular epinephrine	Flush IV/IO dose with 0.5–1 mL normal saline	Flush IV/IO dose with 3 mL normal saline
Expanded timeframe for cessation of resuscitative efforts with confirmed absence of heart rate	Reasonable to stop after 10 minutes of resuscitation; however, decision should be individualized	If appropriate steps have been performed, consider cessation around 20 minutes after birth; however, decision should be individualized based on patient and contextual factors

ET=endotracheal, IO=intraosseous, IV=intravenous.

of less than 28 0/7 weeks' gestation because of a potentially increased risk of severe intraventricular hemorrhage. (9) In vigorous term and late preterm newborns, low to very low certainty evidence suggests that deferring cord clamping for at least 30 seconds improves hematologic measures after birth and, although uncertain, deferring clamping for at least 60 seconds may improve early childhood neurodevelopmental outcomes. (4)

Initial Steps

Although there is no research comparing the order of the initial steps, these steps have been reordered to better reflect common practice. Some of the steps may be completed simultaneously. As described in the NRP 8th edition textbook, the initial steps are warm, dry, stimulate, position the airway, and gently suction the mouth and nose if needed. Immediately after birth, the initial steps of newborn care focus on preventing hypothermia by warming and drying the newborn. Preventing hypothermia is particularly important for preterm newborns. (10)(11) The updated scientific review has confirmed the importance of using a combination of interventions, such as radiant warmers, plastic wraps, hats, and thermal mattresses, to prevent hypothermia in newborns of less than 32 weeks' gestation. (2) When using a combination of interventions, the newborn's temperature must be monitored to prevent unintended hyperthermia. Ongoing research is evaluating the efficacy of various types of tactile stimulation to support initiation of spontaneous respiratory effort. (12)(13)(14) The updated consensus supports the previous guidelines, which recommended using gentle tactile stimulation and ensuring an open airway. If the airway is obstructed by secretions, or if the newborn remains apneic and PPV is anticipated, gentle suction of the mouth and nose is recommended, followed by initiation of PPV.

Research published since release of the NRP 7th edition textbook has provided additional evidence supporting the recommendation against routine immediate laryngoscopy, with or without tracheal suction, for nonvigorous newborns with meconium-stained amniotic fluid. The current ILCOR and AHA recommendations are based on a meta-analysis of 4 small, randomized trials that showed no benefit in the prevention of meconium aspiration syndrome or improvement in survival to hospital discharge from routine laryngoscopy and tracheal suction. (2)(4)(5)(15)(16)(17)(18)(19) The certainty of evidence in this meta-analysis was rated as low or very low largely because the study personnel could not be blinded to the intervention, and the total number of subjects enrolled in the 4 trials (n=571) was below the calculated optimal information size. All 4 randomized trials were completed in India. There has not yet been a randomized trial examining this question in a high-resource setting. Four cohort studies have examined the incidence of meconium aspiration syndrome before and after the NRP 7th edition practice change. (20)(21)(22)(23) Although 1 study found an increase in overall admissions to the NICU for respiratory distress during the epoch following the practice change, no study found an increase in the incidence of meconium aspiration syndrome.

Electronic Cardiac Monitor

In the NRP 8th edition, use of a basic electronic cardiac monitor is recommended earlier during resuscitation than in the NRP 7th edition. Earlier use of a cardiac monitor is advised because HR is the primary indicator of response

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and determines which interventions will be performed. Quickly and accurately determining the newborn's HR is critically important, but clinical assessment has been shown to be unreliable. (24)(25) Research has shown that nearly half of the errors made during NRP simulations are the result of inaccurate HR assessment. Even among healthy newborns, clinicians have difficulty palpating the umbilical pulse and they underestimate the newborn's HR on either auscultation or palpation, which could lead to inappropriate interventions. In addition, when team members are required to calculate and report the HR, they frequently make both calculation and communication errors. (26)

Several studies have shown that an electronic cardiac monitor is the most rapid and accurate way to assess a newborn's HR during resuscitation. (27)(28)(29) It reports the HR faster than pulse oximetry and is more accurate than pulse oximetry during bradycardia. In the unusual setting of pulseless electrical activity, clinicians should be aware that an electronic monitor may show an electrical HR even when there is no cardiac output. (30) Although an electronic cardiac monitor may be considered for high-risk newborns even earlier during resuscitation, the NRP 8th edition textbook recommends that a cardiac monitor should be used to assess the newborn's HR once an alternative airway becomes necessary.

Epinephrine Administration

To improve educational efficiency and patient safety, the suggested initial intravenous (IV) and intraosseous (IO) epinephrine doses have been simplified. The suggested initial IV/IO dose is 0.02 mg/kg (0.2 mL/kg of 0.1 mg/mL solution), and the suggested initial ETT dose is 0.1 mg/kg (1 mL/kg of 0.1 mg/mL solution). The full recommended range has not changed (IV/IO 0.01–0.03 mg/kg; ETT 0.05–0.1 mg/kg), but the single suggested initial dose may be easier for NRP clinicians to remember during an emergency, may improve teamwork by allowing the team member preparing the dose to anticipate what will be requested, and may support easier preparation across a wide range of newborn weights. (4) Although there is emerging evidence that the lower end of the dosing range may be less effective, the simplified doses do not represent an endorsement of any dose within the recommended range. (31) Although administering a single dose of ETT epinephrine is reasonable while vascular access is being secured, the NRP 8th edition continues to caution that ETT epinephrine is unreliable. (32)(33)

To further enhance safety, the NRP 8th edition suggests stocking only the dilute epinephrine solution (0.1 mg/mL, formerly labeled 1:10,000) with neonatal emergency supplies. Other preparations of epinephrine, including a concentrated 1-mg/mL solution, are frequently stocked with adult emergency supplies and are used in the pediatric and adult resuscitation algorithms. If the concentrated solution is available, research has shown that many clinicians will inadvertently use it, potentially resulting in a 10-fold overdose. (34)(35)

In addition to simplifying the initial epinephrine dose, the recommended flush volume after intravascular epinephrine administration has been increased. Evidence from animal studies suggests that a 1-mL flush may deposit epinephrine in the umbilical vein or hepatic circulation rather than allowing it to reach the heart. (36) Pending additional studies to identify the ideal flush volume in newborn human infants, the NRP 8th edition textbook recommends a 3-mL saline flush after either IV or IO epinephrine administration. This single volume applies to all weights and gestations.

Cessation of Resuscitative Efforts

The final practice change involves the timeframe for considering cessation of resuscitative efforts with an absent HR. Failure to achieve an HR after 10 to 20 minutes of intensive resuscitation is associated with a high rate of death or severe impairment among survivors. Identifying the time to stop resuscitative efforts must balance the risk of adverse outcomes among survivors with the desire to not cease efforts in a newborn who would have survived with a good prognosis. In the NRP 7th edition, cessation of resuscitative efforts was considered reasonable after 10 minutes of an absent HR. Based on a recent systematic review, if asystole has been confirmed after all appropriate resuscitative steps have been performed and reversible causes excluded, the NRP 8th edition suggests that it is reasonable to consider cessation of resuscitative efforts around 20 minutes after birth. (2)(4)(37) This allows additional time to complete resuscitative steps and discuss the decision with the clinical team and family. Evidence included in the systematic review indicates that it often takes longer than 10 minutes to perform all appropriate steps. (37) Moreover, contemporary studies suggest that survival without significant neurodevelopmental disability is possible despite an absent HR for 10 minutes after birth. (38)(39) Because it is unlikely that any single recommended duration of resuscitation will accurately predict mortality or severe impairment in all settings, the decision

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to discontinue resuscitative efforts should be individualized based on patient and contextual factors, including gestational age, presence of congenital anomalies, the timing of the perinatal event leading to birth depression, the family's preferences and values, and the availability of postresuscitation intensive care resources. (4)

TEXTBOOK ENHANCEMENTS

In addition to clinical practice changes, the *Textbook of Neonatal Resuscitation,* 8th edition, includes several enhancements to improve learning. Many lessons include Quick Response codes that can be scanned with a mobile device and lead the learner directly to short videos demonstrating key skills. Additional material has been added to the Special Considerations lesson describing the resuscitation and stabilization of newborns with a myelomeningocele or an abdominal wall defect. The NRP 8th edition textbook has new supplemental lessons that include information about improving team performance by considering human factors, ergonomics, and resuscitation outside the delivery room. Because learning how to do something well does not always translate into clinical practice, the textbook has an enhanced focus on quality improvement. An additional supplemental lesson includes information about establishing and sustaining a resuscitation quality improvement program. In addition, suggested process and outcome measures that can be used to support your hospital-based quality improvement program have been added to many lessons.

NRP COURSE OPTIONS

Changes have also been implemented to the structure of the curriculum and the methods of delivering the course. The NRP curriculum has always been based on adult education principles including self-efficacy, experiential learning, reflection, problem solving, internal motivation, and the importance of transformative experiences, but the design has evolved over time. (3)(40) To further support contextual learning and allow clinicians to excel in the course material most relevant to their role during neonatal resuscitation, the NRP 8th edition course offers 2 levels of learning: NRP essentials and NRP advanced. Each organization will decide who should be NRP essential clinicians and who should be NRP advanced clinicians. The NRP essentials learner is responsible only for material in lessons 1 through 4. That includes the foundations of neonatal resuscitation, anticipating and preparing for resuscitation, the initial steps, PPV with a face mask and laryngeal mask, and CPAP administration. The NRP advanced learner is responsible for the NRP essentials components as well as the material in lessons 5 through 11, including intubation, chest compressions, emergency medication administration, resuscitation of preterm infants and those with abdominal wall and neural tube defects, management of a pneumothorax or pleural effusion, postresuscitation care, and end-of-life care. If learners will only initiate unanticipated resuscitation with PPV and will not participate in advanced resuscitation because a fully trained team is immediately available to take over, they may be assigned the NRP essentials course. If clinicians may participate in resuscitations that require skills beyond PPV, they need to complete the NRP advanced course. Although 2 levels are offered, hospitals may require all clinicians who participate in resuscitations to complete the NRP advanced course.

The NRP 8th edition also introduces the option to use Resuscitation Quality Improvement (RQI®) for NRP. Several educational best practices are incorporated into this option for delivering the NRP essentials course, including mastery learning and distributed practice. (41) This is an alternative to the traditional instructor-led course in hospitals that subscribe to the RQI program. RQI for NRP is a self-directed, high-frequency, low-intensity, simulation-based program incorporating mastery learning with deliberate practice and automated feedback for lessons 1 through 4. It uses brief quarterly online simulations and hands-on PPV practice using a manikin with a sensor at a mobile kiosk and is a method that has already been used by other AHA-sponsored resuscitation courses. In hospitals that use RQI for NRP, everyone maintains their essentials provider status by completing quarterly cognitive and skills activities at the mobile kiosk, but advanced providers must also complete an instructor-led advanced provider course every 2 years to maintain their advanced provider status.

PRINCIPLES THAT HAVE NOT CHANGED

Many key principles have not changed in the NRP 8th edition. The program continues to emphasize the importance of anticipation, preparation, and team briefings. The emphasis on achieving effective ventilation continues. Most newborns who require resuscitation will recover with effective ventilation of their lungs and will not require either chest compressions or epinephrine. (4) However, mask ventilation can be a difficult skill to achieve and maintain. Both obstruction and mask leak are common, occurring in nearly half of assisted breaths delivered to preterm newborns. (42) As a result, it is important to learn how to implement the MR. SOPA ventilation corrective steps. The NRP 8th edition textbook continues to

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Figure 2. Two-hand hold on face mask. (Reprinted with permission from Weiner GM, Zaichkin J. *Textbook of Neonatal Resuscitation*. 8th ed. Itasca, IL: American Academy of Pediatrics; 2021.)

Figure 4. Insertion of a laryngeal mask. (Reprinted with permission from Weiner GM, Zaichkin J. *Textbook of Neonatal Resuscitation*. 8th ed. Itasca, IL: American Academy of Pediatrics; 2021.)

emphasize using the correct size mask, correctly positioning the airway, and learning the 2-hand hold. In manikin studies, the 2-hand hold (Fig 2) significantly reduces mask leak. (43) The addition of a colorimetric carbon dioxide detector, or capnometer, between the mask and PPV device (Fig 3) can improve mask ventilation. (44) If the lungs are ventilated and gas is exchanged, a colorimetric detector will change from purple to yellow. As teams proceed through the MR. SOPA steps, if the detector changes color after performing a step, the newborn's HR will likely improve within 30 seconds. (45) If the team member positioning the airway becomes distracted and changes position, the detector will change back to purple and can help identify the positioning error before the infant becomes bradycardic. On the other hand, if the detector does not change color, it is another indication to proceed to the next ventilation corrective step.

Even with corrective steps, mask ventilation is not always successful, and teams must be prepared to insert an alternative airway. Overall, first attempt success with tracheal intubation is low. (46) The NRP 8th edition textbook suggests considering the use of a video-laryngoscope especially when working with trainees. Use of a video-laryngoscope allows the supervisor to provide more effective coaching by seeing what the operator is seeing. Among trainees intubating newborns, studies have shown that use of a video-laryngoscope improves first attempt success. (47)(48) Finally, the NRP 8th edition continues to include the laryngeal mask on the standard list of equipment and supplies for every delivery room. It is a simple device that requires no instruments for insertion (Fig 4) and has a very high first attempt successful insertion rate with limited training. (49) Insertion of a laryngeal mask may save a newborn's life if intubation is unsuccessful or not feasible.

Figure 3. Use of a colorimetric carbon dioxide detector with face-mask ventilation.

Summary

Although most newborns require no assistance to successfully transition to extrauterine life, the large number of births each year and limited ability to predict which newborns will need assistance means that skilled clinicians must be prepared to respond quickly and efficiently for every birth. Since its release in 1987, the NRP has trained over 4.5 million health professionals in the cognitive, technical, and behavioral skills required to save newborn lives. The NRP 8th edition builds on an established history of innovation and collaboration while adding new elements of instructional design to better meet the needs of different health professionals. As new research answers gaps in our neonatal resuscitation knowledge base

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and new technologies emerge, the program will continue to evolve.

American Board of Pediatrics Neonatal-Perinatal Content Specifications

- Know the proper approach to airway management in the delivery room.
- Know the indications for assisted ventilation, including continuous positive airway pressure, immediately after birth and how to assess its effectiveness.
- Understand how to use self-inflating and flow-inflating bags or T-piece resuscitators to provide assisted ventilation immediately after birth.
- Know indications for and proper administration of supplemental oxygen immediately after birth.
- Know the indications for, techniques, and potential complications of chest compression immediately after birth.
- Know the indications, contraindications, and methods of administration of drugs used for neonatal resuscitation.

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NEO QUIZ

1. The Neonatal Resuscitation Program® (NRP) was first published in 1987 by the American Academy of Pediatrics (AAP). The NRP guidelines address the resuscitation needs of newborns immediately after birth. Although most neonates initiate breathing spontaneously or after stimulation and drying, some require positive pressure ventilation (PPV). What is the percentage of newborns requiring PPV at birth?

   A. <1%.
   B. 5%–7%.
   C. 15%–18%.
   D. 21%–24%.
   E. 28%–31%.

2. Clinicians preparing for the birth of a newborn should meet with the obstetrical team to determine the likelihood of need for resuscitation at birth by asking 4 prebirth questions. Which of the following prebirth questions is now included in the NRP 8th edition textbook?

   A. What is the maternal breastfeeding plan?
   B. What is the umbilical cord management plan?
   C. What is the infant's presentation?
   D. What is the maternal COVID-19 status?
   E. What is the last maternal temperature?

3. Evidence supports the use of electronic cardiac monitoring during neonatal resuscitation as the most rapid and accurate way to assess a newborn's heart rate (HR). The NRP 8th edition textbook recommends the use of a cardiac monitor earlier than in the NRP 7th edition. Although electronic cardiac monitoring may begin earlier, the NRP 8th edition recommends that electronic cardiac monitoring should be initiated when which of the following begins?

   A. Tactile stimulation.
   B. Oropharyngeal suction.
   C. Positive pressure ventilation.
   D. Placement of an alternative airway.
   E. Epinephrine administration.

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4. Although the full recommended dosing range of epinephrine was not changed, the initial dose of epinephrine has been simplified in the NRP 8th edition textbook to improve educational efficiency and patient safety. Which of the following statements regarding the initial dose of epinephrine is correct?

   A. The suggested initial dose is 0.01 mg/kg for intravenous (IV)/intraosseous (IO) administration and 0.1 mg/kg for endotracheal tube (ETT) administration.
   B. The suggested initial dose is 0.02 mg/kg for IV/IO administration and 0.05 mg/kg for ETT administration.
   C. The suggested initial dose is 0.03 mg/kg for IV/IO administration and 0.1 mg/kg for ETT administration.
   D. The suggested initial dose is 0.02 mg/kg for IV/IO administration and 0.1 mg/kg for ETT administration.
   E. The suggested initial dose is 0.01 mg/kg for IV/IO administration and 0.05 mg/kg for ETT administration.

5. Cessation of resuscitative efforts may have to be considered when neonates do not respond to appropriate resuscitative steps. The decision to discontinue resuscitative efforts should be individualized based on gestational age, presence of congenital anomalies, timing of the perinatal event leading to birth depression, the family's preferences and values, and availability of postresuscitation intensive care resources. According to the NRP 8th edition textbook, when is it reasonable to consider cessation of resuscitative efforts?

   A. After 10 minutes of appropriate resuscitative steps.
   B. After 15 minutes of appropriate resuscitative steps.
   C. After 20 minutes of appropriate resuscitative steps.
   D. After 25 minutes of appropriate resuscitative steps.
   E. After 30 minutes of appropriate resuscitative steps.

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