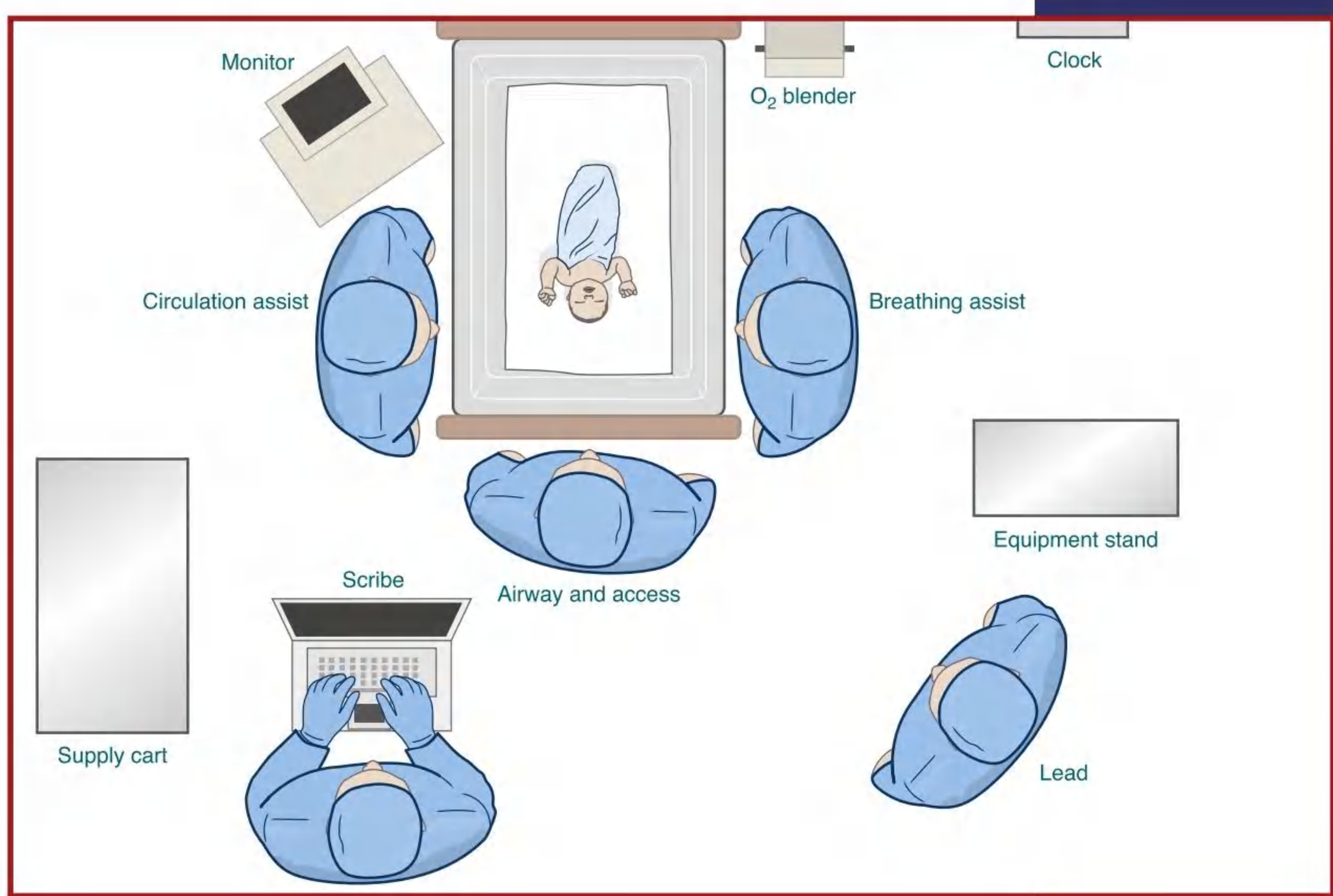
SUPPLEMENTAL LESSON

12

Improving Resuscitation Team Performance

What you will learn

- How attention to ergonomics and human factors improves resuscitation team performance
- The 3 essential elements of a pre-resuscitation team briefing
- How to develop resuscitation schemes by assigning team roles, tasks, and positions
- How to use simulation and debriefing to test and improve your resuscitation schemes



Key Points

1. Beyond individual team members learning the cognitive and technical skills of resuscitation, considering human factors and the ergonomics of resuscitation can further improve safety and performance.

2. By understanding how humans perform a series of tasks in a real work environment, teams can predict where errors may occur, design systems that prevent these errors, and optimize team performance.

3. During your pre-resuscitation briefing, define the situation, assign roles with standardized tasks, and position team members in the environment.

4. Assigning roles sets expectations, allows adult learners to practice tasks repeatedly, increases confidence in their ability to perform, decreases extraneous noise, and reduces cognitive load.

5. Schemes (descriptive plans or conceptual models) for delivery room resuscitation need to be individualized. Each hospital's role and task list will vary depending on the professional disciplines involved, the scope of practice for each discipline, and the number of resuscitation team members available for different resuscitation scenarios.

6. During a resuscitation, roles may need to be added or changed. How information is provided to arriving personnel and what roles they assume should be predetermined.

7. After you have created your schemes, conduct frequent simulated resuscitations to audit team performance, find weaknesses in your plan, and identify opportunities for improvement.

The role of ergonomics and human factors in neonatal resuscitation

This lesson focuses on improving resuscitation team performance. When resuscitation team members are assigned roles, and human factors and ergonomics are considered when assigning specific tasks to those roles, team members can work in synchrony. The resuscitation proceeds quickly and efficiently through an organized series of

interventions and effective communication. The teamwork is so well organized that it appears choreographed.

The science of ergonomics analyzes human anatomy, physiology, and biomechanics to better understand how the work environment can be adapted to improve safety and performance. Ergonomics evaluates how equipment is used and what demands the equipment places on the user.

Over time, new technology has been added to the Neonatal Resuscitation Program® (NRP®) Algorithm. While new technology may improve the care we provide, it also adds to the amount of data we must interpret and may increase the cognitive load on team members. Increasing the number of devices, people, complexity of tasks, and cognitive load may correlate with an increase in noise, a decrease in effective communication, and an increase in deviations from the NRP Algorithm.

Often, simple adjustments to the working environment can make a significant difference in performance. During neonatal resuscitation, appropriate positioning of people and equipment is essential. For example,

- If the pulse oximeter has excessive glare on the screen or is obstructed from view and team members cannot see the display, they may not assess the baby's oxygen saturation and adjust the oxygen concentration (FIO_2).
- If the oxygen blender is on the right side of the radiant warmer, it is difficult for team members positioned at the head of the bed or on the left side to adjust the FIO_2.
- If a tall provider attempts to intubate a newborn with a low radiant warmer that has no height adjustment, their awkward body position may decrease the likelihood of successful intubation.
- Confirming endotracheal tube insertion is difficult if the radiant warmer is positioned in a corner of the room that is not easily accessible by an x-ray machine.

Human factors research investigates how humans interact with their environment, products, other humans, and technology. It combines an understanding of psychology, sociology, biomechanics, industrial design, and other related disciplines. Human factors research has taught us that individual team members may know the steps of resuscitation and have the technical skills to perform them, but that time can be wasted if roles are ambiguous and tasks are not assigned as team members duplicate some tasks and omit others. By understanding how humans will perform a series of tasks in a real work environment,

human factors experts attempt to predict where errors may occur, design systems that prevent these errors, and optimize team performance. For example,

- Using tables with pre-calculated epinephrine dosages can decrease the risk of making mathematical errors during a stressful situation.
- Incorporating human factors into resuscitation simulation and team briefing before a high-risk birth increases provider confidence and decreases distractions and noise.

Table 12-1 lists strategies to improve safety and team performance by addressing common ergonomic and human factors obstacles.

Table 12-1. Strategies to Address Ergonomic and Human Factors Obstacles

Use cognitive aids such as the NRP Algorithm, Target Oxygen Saturation Table, and tables with endotracheal tube insertion depth and pre-calculated epinephrine dosages.
Use a standardized team briefing script.
Use a standardized supplies and equipment checklist.
Assign roles as part of a routine pre-resuscitation team briefing.
Create a standard description of the tasks that each role is expected to complete during a resuscitation.
Create standardized protocols and scripts for introducing additional team members arriving at a complex resuscitation.
Assign 1 team member the role of crowd control during a complex resuscitation.
Conduct frequent simulation training in the actual resuscitation environment.
Develop organized schemes to position personnel and equipment appropriately within the resuscitation environment.
Evaluate the accessibility and ergonomic function of resuscitation supplies and equipment.
Assess the tone and alarm volume on monitors used during resuscitation to be certain they can be heard but do not add to auditory overload.

How to perform a structured pre-resuscitation team briefing

You learned about the importance of conducting a pre-resuscitation team briefing in Lesson 2. The team briefing is used to review the risk factors and any plan of care developed during antenatal counseling. At this briefing, the team leader is identified, possible scenarios your team may encounter are discussed, and roles and responsibilities are assigned.

There are 3 essential elements when planning a pre-resuscitation team briefing.

- *Defining* the situation
- *Assigning* roles and setting clear, detailed expectations for each role
- *Positioning* each team member within the resuscitation environment

Standardizing the pre-resuscitation team briefing to include these essential elements will help decrease variability and increase reliability. Reliable systems improve team performance and outcomes.

When possible, the pre-resuscitation team briefing should occur well before the anticipated birth. One way to ensure teams get the opportunity to assemble prior to an event is to schedule a meeting with the obstetric team at the beginning of each shift to identify potential high-risk births. This allows both teams to have an opportunity to meet face-to-face, assign roles, answer questions, and create both primary and contingency plans.

The importance of assigning roles and setting expectations

The NRP Key Behavioral Skills promote preparation for, and successful coordination of, delivery room resuscitation. There is growing evidence that improved behavioral and team leadership skills improve resuscitation outcomes. Stress increases when team members do not know what to expect from one another and the team leader does not know, or incorrectly assumes, what team members are going to do. Assigning roles sets expectations and allows adult learners to practice these specific tasks repeatedly, which results in increased confidence in their ability to perform. When team members know their roles and expectations are set in advance, there is less extraneous noise during the resuscitation. The decreased noise translates into less distractions from required tasks and reduces cognitive load.

One method to standardize role assignments is to assign roles based on a team member's position at the radiant warmer. Each team member is given a specific role with a predefined list of tasks and a designated location at the radiant warmer that optimizes ergonomics. Role assignments take the guesswork out of who does what and have been shown to improve resuscitation performance.

What is a resuscitation scheme?

Schemes are detailed, systematic plans of action that may be illustrated in the form of outlines or conceptual models. A resuscitation scheme describes your plan for how to organize the personnel, equipment, and tasks during a resuscitation. The full resuscitation scheme includes planning what personnel will be present, what supplies and equipment will be available, what role each person will have, what tasks will be assigned to each role, and where each team member will be placed

during the resuscitation. The scheme must consider how many tasks each team member can efficiently perform and whether the equipment required to perform those tasks is easily accessible within the resuscitation environment. A schematic is an illustration or table that describes your plan.

Designing schemes for a variety of resuscitation scenarios in your own environment is well worth the effort. High-performing teams with well-defined schemes experience less cognitive load, which allows them to focus their attention on other skills. Schemes for delivery room resuscitation need to be individualized to your specific location, equipment, and personnel.

Figure 12.1 is a sample schematic describing roles and pre-birth task assignments for a 5-member team preparing for a very preterm birth. The schematic describes where personnel stand and where important supplies are placed on the radiant warmer to ensure easy accessibility during resuscitation or post-resuscitation care. Figure 12.2 is a sample schematic for the placement of each team member by role based on the configuration of this particular hospital's resuscitation environment.

Time	Airway and Access (Head of bed)	Breathing (Right)	Circulation (Left)	Lead (Back right)	Scribe (Back left)
Pre-delivery	**Meet with OB:** ☐ Confirm 1. Pertinent history 2. Delayed cord clamping plan 3. OR temperature 4. Placement into plastic bag ☐ Talk to family ☐ Determine special equipment or personnel needs **At Warmer** ☐ Double-check: 1. Laryngoscope 2. ETTs 3. T-piece 4. CO_2 detector 5. Round mask (choose size) ☐ Raise height of bed to level of xiphoid process	**Prepare PPV:** ☐ Ventilator set-up ☐ Test T-piece: 20/5, 30% ☐ Round mask, small and extra small ☐ CO_2 detector on mask ☐ Pulse ox and cover (lower right) ☐ Stethoscope on **Prepare ETT:** ☐ Laryngoscope handle, size 0 and 00 blades ☐ 2.5 and 3.0 ETT and stylet (top right) ☐ ETT securing device (lower right) ☐ Measuring tape (lower right) **CPAP prep** ☐ CPAP at bedside set to 6 cm H_2O For infants < 28 weeks: ☐ Surfactant warming	**Prepare bed:** ☐ 1 blanket, 1 blue pad, 1 blanket, thermal blanket, blanket ☐ Warmer to max ☐ Temperature probe (lower left) ☐ Activate thermal blanket ☐ Hat (top left) ☐ Suction catheter at 80 mm Hg (right) ☐ Bulb syringe (top right) ☐ ECG leads (left) ☐ Two 4x4 gauze (lower right and lower left) ☐ Stethoscope on **Prepare monitor:** Audible ECG on	**Prepare line tray:** ☐ 3.5F umbilical artery catheter ☐ 3.5F umbilical venous catheter ☐ Umbilical venous catheter/umbilical artery catheter supply tray ☐ 2 stopcocks ☐ Equipment stand ☐ 2x3-mL syringes ☐ 3 sterile towels ☐ Prime IV lines	**Prepare supplies:** ☐ Humidity: add sterile H_2O to isolette ☐ 3x5-mL saline with heparin flushes ☐ Glucose meter ready ☐ 2x infusion pumps ☐ Pre-admission order set complete ☐ Very low birth weight IV fluids ordered ☐ Alert NICU unit clerk ☐ Confirm NICU attending called ☐ Calculator ☐ Computer on, Neonatal Resuscitation Log ready

Figure 12.1. Sample pre-birth task assignment schematic for a very preterm birth

Following the 5-member schematic demonstrated in Figure 12.2, examples of the tasks that may be assigned by role after birth are described in the following text.

- **Airway and Access:** The person at the head of the bed is well positioned to manage the airway. Tasks assigned to this role may include applying a hat, positioning the newborn's head and neck, performing bulb suction, positioning the face mask, providing face-mask positive-pressure ventilation (PPV), and intubating the newborn if necessary. If chest compressions are needed, this team member hands over PPV to the Breathing Assist role, allows the Circulation Assist to move to the head of the bed to provide chest compressions, and then moves into position to insert an emergency umbilical venous catheter.
- **Breathing Assist:** The person on the right side of the bed is well positioned to access the right hand or wrist, monitor pulse oximetry, and adjust the oxygen blender. The team member in this role focuses on assisting with the assessment and support of breathing. Tasks assigned to this role may include turning on the Apgar timer, applying the pulse oximeter sensor, assisting with ventilation corrective steps, monitoring for chest movement, placing a carbon dioxide (CO_2) detector on the face mask if requested, monitoring for color change on the CO_2 detector, assisting with intubation and securing the endotracheal tube if needed, assessing breath sounds, monitoring oxygen saturation, and adjusting the FIO_2. If chest compressions are needed, this person takes over PPV through the endotracheal tube.
- **Circulation Assist:** The person on the left side of the bed is well positioned to see the baby's chest but cannot easily reach the baby's right hand or the oxygen blender. The team member in this role focuses on assisting with temperature control, assessing circulation, and providing chest compressions if needed. Tasks assigned to this role include placing cardiac monitor leads, assessing heart rate with a stethoscope, placing a temperature sensor, ensuring the polyethylene plastic bag or wrap remains over the newborn's shoulders, assisting with securing the endotracheal tube as needed, and administering chest compressions from the head of the bed.
- **Lead:** This person is ideally positioned to maintain situation awareness and lead the team. Ideally, the team member in this role is not assigned other tasks. Depending on the availability of additional personnel and scope of practice, the Lead may be needed to assist with emergency procedures. If this occurs, another team member must assume the Lead role.

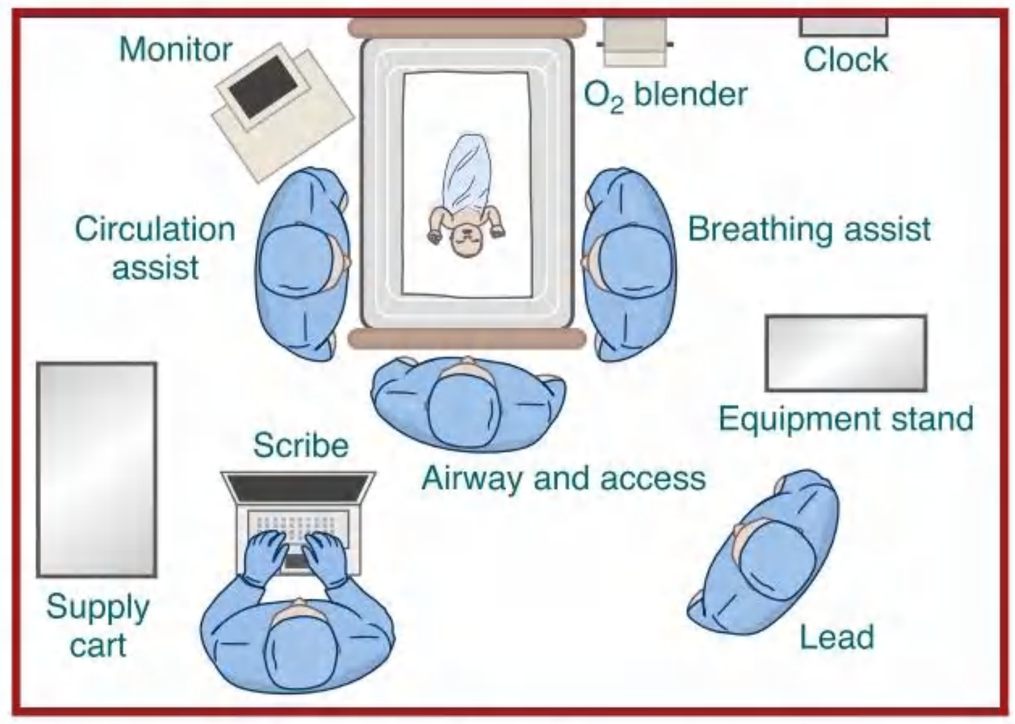


Figure 12.2. Sample 5-member team position schematic for a complex resuscitation

- **Scribe:** This person is well positioned to see the monitors, clock, and all team members. The team member in this role documents events as they occur, notifies the team of critical time points, maintains critical communication with the Lead, and may call for additional support. In a 5-member team, if chest compressions are required and additional support is not available, this person will hand over recording to the Lead and assume the task of preparing and administering emergency medications.

At a hospital that has more personnel available, the same scenario may be managed using a 6- or 7-member team. In these schemes, the team may have designated Medication and Access roles. As the team gets larger, managing the number of people and equipment that can efficiently work in a small space becomes an important consideration. A larger team may include a Manager role whose tasks include crowd control, information dissemination (eg, laboratory results), parent support, and assigning roles as new personnel arrive.

How do roles in the scheme change if resuscitation is unexpected?

Roles may need to be added or changed in a planned and coordinated way depending on the baby's needs and the team members' scope of practice. How information is provided to arriving personnel and what roles they assume should be predetermined.

For example, if only 1 nurse attends the birth of a full-term baby who unexpectedly requires resuscitation, the nurse initially assumes the Airway and Lead role at the head of the bed, initiates PPV, and presses an emergency call button for immediate assistance. The first person who comes to assist (in this scenario, another nurse) is predesignated to assume the Breathing Assist role on the baby's right. This nurse places a pulse oximeter sensor, assesses the baby's response to PPV and adjusts the Fio_2 as needed, and places cardiac monitor leads if the baby is not showing improvement. The third person to arrive, an advanced practice provider, is directed by the Airway nurse to take the Circulation Assist role if face-mask PPV is effective or the Airway role if intubation is required. If the third person assumes the Airway role, the original nurse moves to the left side of the bed and assumes the Circulation Assist role. Staff arriving later may assume the Lead and Scribe roles.

The schematics in Figures 12.3 through 12.5 illustrate how these roles might evolve. In this hospital's environment, the pulse oximeter and oxygen blender are integrated within the radiant warmer and emergency supplies are stored in a drawer below the warmer.

How do we create our own hospital system for standardizing roles and tasks?

Each hospital's role and task list will vary depending on the professional disciplines involved, the scope of practice for each discipline, the placement of equipment around the warmer, and the number of resuscitation team members available for different resuscitation scenarios. Even hospitals that routinely provide only uncomplicated obstetric services must plan schemes for complex resuscitations because unanticipated complications can arise, such as a depressed newborn secondary to shoulder dystocia or placental abruption, deliveries complicated by meconium aspiration, undiagnosed congenital malformations, unanticipated preterm birth, or other complications resulting in neonatal respiratory or neurologic depression.

- The first step is to determine the personnel available to attend resuscitations of varying complexity at your facility.
- Next, make a comprehensive list of every task that must be done to prepare for the birth and resuscitation of newborns in these scenarios. For example, the list of tasks required to resuscitate a term newborn who requires brief PPV at birth and quickly recovers will be much shorter than the list of tasks required to prepare for and resuscitate a baby born at 26 weeks' gestation.
- Once you have determined the available personnel and the tasks to be performed, you can begin the process of assigning proposed roles and tasks. Decide where each person should stand and where supplies and equipment can be placed to ensure they are easily accessible to the person who must use them.
- Finally, simulate a series of carefully monitored scenarios, test your proposed role and task assignments, identify potential barriers or inefficient processes, make adjustments to optimize team performance, and test your new proposal until you develop a final plan that describes your scheme for each scenario.

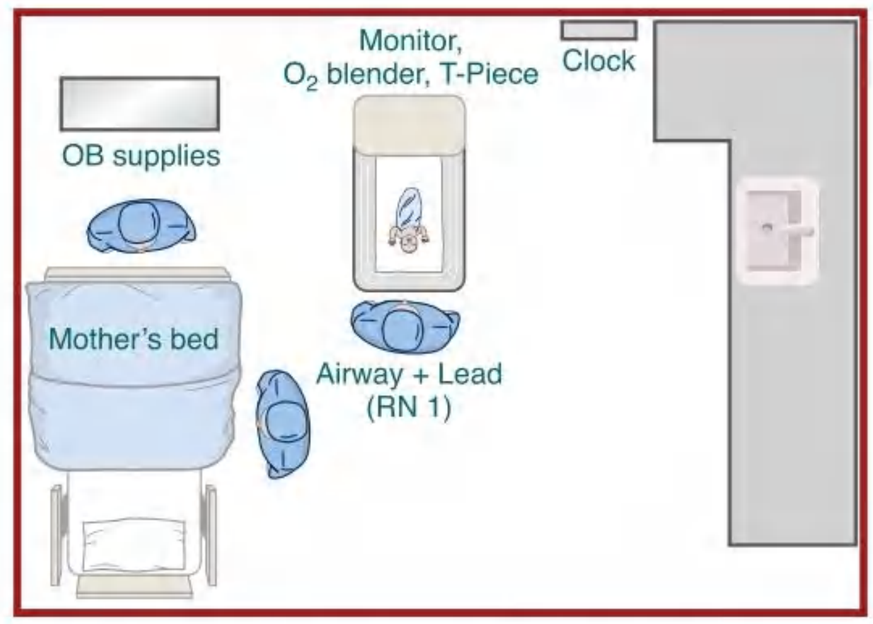


Figure 12.3. Evolution of roles and positions as personnel arrive for an unexpected resuscitation. A term newborn requires unanticipated PPV. One nurse (RN 1) is present for the birth.

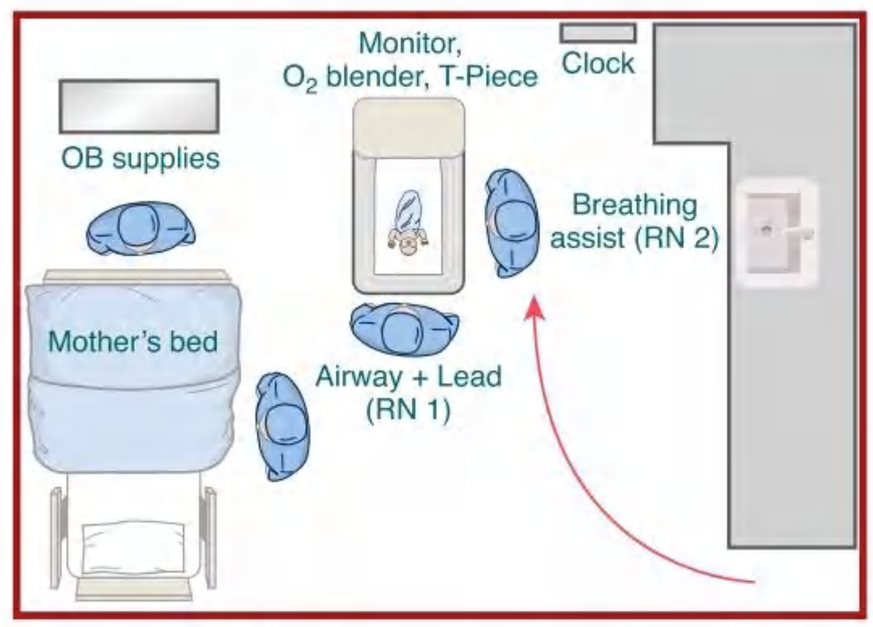


Figure 12.4. A second nurse arrives (RN 2) and assumes the Breathing Assist role.

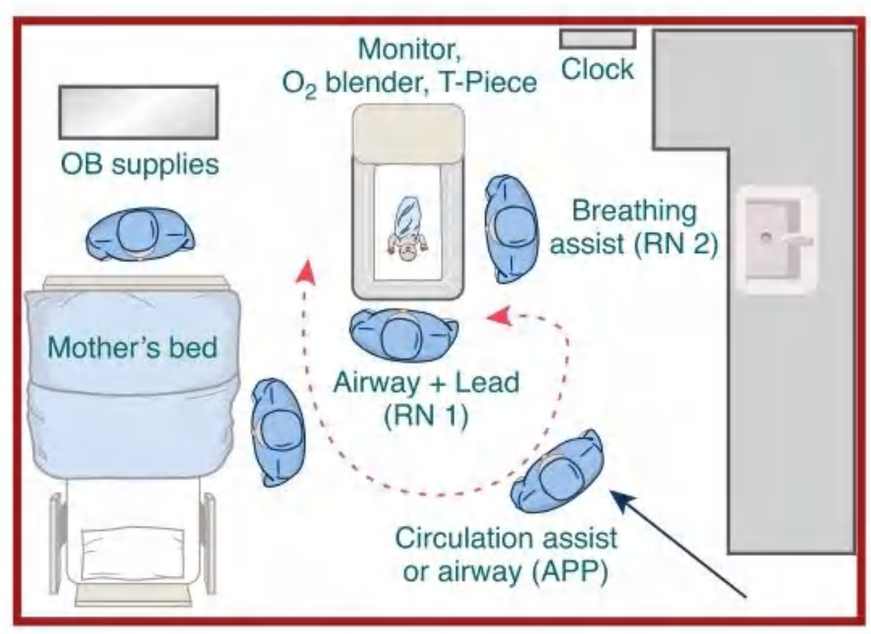


Figure 12.5. An advanced practice provider (APP) arrives and is directed to take the Circulation Assist role if face-mask PPV is effective or assume the Airway role if the baby needs to be intubated. If the APP assumes the Airway role to intubate, RN 1 will maintain the Lead role.

How will you assess the effectiveness of your new standardized system?

After you have created your schemes, conduct frequent simulated resuscitations using different scenarios to audit your performance, find weaknesses in your plan, and identify opportunities for improvement. Simulation can identify ergonomic and human factors issues, evaluate the effectiveness of your pre-resuscitation briefing, and reinforce team roles and responsibilities. Consider video-recording your scenarios to support detailed debriefings. Review the video recordings with your team and watch carefully for inefficient practices and potential safety threats.

- Begin with a simple PPV scenario, adjust your assigned tasks as needed, and work up to a complex resuscitation involving umbilical venous catheter insertion and medications.
- Adjust the tasks assigned to each role until team members are able to work quickly and efficiently without getting in each other's way. Your simulation may reveal a series of small problems that could be resolved with simple solutions. You may notice that the placement of monitors is not ideal for all team members, or discover that the supplies for an assigned task are not easily accessible. For example,
  - The person placing the pulse oximeter sensor on the baby's right hand or wrist should be on the baby's right side; otherwise, the team member has to reach over the baby.
  - The person adjusting the FIO_2 should be able to reach the dial on the oxygen blender.
  - The person calling for additional help should be able to reach the call button or phone without interfering with their existing tasks.
- Be sure to include the Scribe role during simulation because the Scribe must be able to see the baby, see the monitors, see and hear the team members, and see the time device being used for code documentation.