

# Neonatal ICU

## Description:

This rotation is designed to provide the resident exposure to and experience with a variety of neonatal conditions and complications. Residents will admit and manage a core group of patients appropriate to their level of training. They will complete history and physical exams and then review them with the attending neonatologist. They will be expected to initiate treatment at a level appropriate for their training. With each successive rotation, the resident will be expected to increase the complexity and responsibility of their patient care as well as increase their supervision and teaching of junior members of the NICU team. They will also be required to achieve "Code Pink" status. The resident will participate in multidisciplinary rounds and patient care planning, prenatal counseling, family conferences and ethical discussions.

The goals and objectives described in detail below are not meant to be completed in a single one month block rotation but are meant to be cumulative, culminating in a thorough and complete NICU experience at the end of residency.

## Primary Goals for this Rotation

**GOAL: Perinatal Prevention. Understand the pediatrician's role in and become an active advocate for programs to reduce morbidity and mortality from high-risk pregnancies.**

Identify and describe strategies to reduce fetal and neonatal mortality, including use of group B strep prophylaxis, perinatal steroids.

Understand and know how to access:

1. Basic vital statistics that apply to newborns (neonatal and perinatal mortality, etc)
2. Prenatal services available in one's region
3. Tests commonly used by obstetricians to measure fetal well-being
4. Neonatal transport systems

Describe effective intervention programs for teens and other high-risk mothers.

Recognize potential adverse outcomes for the fetus and neonate of common prenatal and perinatal conditions, and demonstrate the pediatrician's role in assessment and management strategies to minimize the risk to the fetus and/or newborn in the following situations:

1. Maternal infections/exposure to infection during pregnancy
2. Fetal exposure to harmful substances (alcohol, tobacco, environmental toxins, medications, street drugs)
3. Maternal insulin-dependent diabetes and pregnancy-induced glucose intolerance
4. Multiple gestation
5. Placental abnormalities (placenta previa, abruption, abnormal size, function)
6. Pre-eclampsia, eclampsia
7. Chorioamnionitis
8. Polyhydramnios
9. Oligohydramnios
10. Premature labor, premature ruptured membranes

11. Complications of anesthesia and common delivery practices (e.g., Caesarian, vacuum, forceps assisted, epidural, induction of labor)
12. Fetal distress during delivery
13. Postpartum maternal fever or infection
14. Maternal blood group incompatibilities
15. Other common maternal conditions having implications for the infant's health such as lupus, HELLP syndrome, maternal thrombocytopenia

**GOAL: Resuscitation and Stabilization. Assess, resuscitate and stabilize critically ill neonates.**

Explain and perform steps in resuscitation and stabilization, particularly airway management, vascular access, volume resuscitation, indications for and techniques of chest compressions, resuscitative pharmacology and management of meconium deliveries.

Describe the common causes of acute deterioration in previously stable NICU patients.

Function appropriately in codes and neonatal resuscitations as part of the NICU team by:

1. Participating in resuscitations
2. Completing Neonatal Resuscitation Program (NRP) or comparable training
3. Using neonatal resuscitation drugs appropriately

**GOAL: Common Signs and Symptoms. Evaluate and manage, under the supervision of a neonatologist, common signs and symptoms of disease in premature and ill newborns.**

Under supervision, evaluate and manage patients with the signs and symptoms that present commonly in the NICU (examples below).

1. General: feeding problems, history of maternal infection or exposure, hyperthermia, hypothermia, intrauterine growth failure, irritability, jitteriness, large for gestational age, lethargy, poor post-natal weight gain, prematurity (various gestational ages)

2. Cardiorespiratory: apnea, bradycardia, cyanosis, dehydration, heart murmur, hypertension, hypotension, hypovolemia, poor pulses, respiratory distress (flaring, grunting, tachypnea), shock

3. Dermatologic: birthmarks, common skin rashes/conditions, discharge and/or inflammation of the umbilicus, hyper- and hypopigmented lesions, proper skin care for extreme prematures

4. GI/surgical: abdominal mass, bloody stools, diarrhea, distended abdomen, failure to pass stool, gastric retention or reflux, hepatosplenomegaly, vomiting

5. Genetic/metabolic: apparent congenital defect or dysmorphic syndrome, metabolic derangements (glucose, calcium, acid-base, urea, amino acids, etc.)

6. Hematologic: abnormal bleeding, anemia, jaundice in a premature or seriously ill neonate, neutropenia, petechiae, polycythemia, thrombocytopenia

7. Musculoskeletal: birth defects and deformities, birth trauma and related fractures and soft tissue injuries, dislocations

8. Neurologic: birth trauma related nerve damage, early signs of neurologic impairment, hypotonia, macrocephaly, microcephaly, seizures, spina bifida

9. Parental stress and dysfunction: anxiety disorders, child abuse and neglect, poor attachment, postpartum depression, substance abuse, teen parent

10. Renal/urologic: abnormal genitalia, edema, hematuria, oliguria, proteinuria, renal mass, urinary retention

**GOAL: Common Conditions. Recognize and manage, under the supervision of a neonatologist, the common conditions in patients encountered in the NICU.**

Under supervision, evaluate and manage patients with conditions that present commonly in the NICU (examples below):

1. General: congenital malformations
2. Cardiovascular: cardiomyopathy, congenital heart disease (cyanotic and acyanotic--e.g., common disorders such as patent ductus arteriosus, ventricular septal defect, tetralogy of Fallot, transposition of the great arteries), congestive heart failure, dysrhythmias (e.g. supraventricular tachyarrhythmia, complete heart block), pericarditis
3. Genetic, endocrine disorders: abnormalities discovered from neonatal screening programs as they affect the premature infant, common chromosomal anomalies (Trisomy 13, 18, 21, Turner's), inborn errors of metabolism, infant of a diabetic mother, infant of a mother with thyroid disease (e.g. maternal Graves Disease), uncommon conditions such as congenital adrenal hyperplasia, hypothyroidism, hyperthyroidism
4. GI/nutrition: biliary atresia, breast feeding support for mothers and infants with special needs (high risk premature, maternal illness, multiple birth, etc.), complications of umbilical catheterization, gastroesophageal reflux, growth retardation, hepatitis, hyperbilirubinemia, meconium plug, necrotizing enterocolitis, nutritional management of high risk neonates or those with special needs (cleft lip/palate, other facial anomalies, etc.)
5. Hematologic conditions: coagulopathy of the newborn, erythroblastosis fetalis, hemophilia, hydrops fetalis, hyperbilirubinemia, splenomegaly
6. Infectious disease: central line infections, Group B Streptococcal infections, hepatitis, herpes simplex, immunization of the premature neonate, infant of mother with HIV, intrauterine viral infections, neonatal sepsis and meningitis, nosocomial infections in the NICU, syphilis, ureaplasma, varicella exposure
7. Neurologic disorders: central apnea, CNS malformations (e.g. encephalocele, porencephaly, holoprosencephaly), drug withdrawal, hearing loss in high risk newborns (prevention and screening), hydrocephalus, hypoxic-ischemic encephalopathy, intraventricular hemorrhage, retinopathy of prematurity, seizures, spina bifida
8. Pulmonary disorders: atelectasis, bronchopulmonary dysplasia, meconium aspiration, persistent pulmonary hypertension of the newborn, pneumonia, pneumothorax, respiratory distress syndrome, transient tachypnea of the newborn
9. Renal: acute and chronic renal failure, hematuria, hydronephrosis, oliguria, proteinuria
10. Surgery [assess and participate in management under supervision of a pediatric surgeon or cardiac surgeon]: congenital heart disease, (cyanotic, patent ductus arteriosus, obstructive left-sided cardiac lesions, pre- and post-operative care), diaphragmatic hernia, esophageal or gut atresia, gastroschisis, omphalocele, intestinal obstruction, necrotizing enterocolitis, perforated viscus, Pierre Robin

syndrome, volvulus

**GOAL: Diagnostic Testing. Under the supervision of a neonatologist, order and understand the indications for, limitations of, and interpretation of laboratory and imaging studies unique to the NICU setting.**

Demonstrate understanding of common diagnostic tests and imaging studies used in the NICU by being able to:

1. Explain the indications for and limitations of each study.
2. Know or be able to locate readily gestational age-appropriate normal ranges (lab studies).
3. Apply knowledge of diagnostic test properties, including the use of sensitivity, specificity, positive predictive value, negative predictive value, likelihood ratios, and receiver operating characteristic curves, to assess the utility of tests in various clinical settings.
4. Recognize cost and utilization issues.
5. Interpret the results in the context of the specific patient.
6. Discuss therapeutic options for correction of abnormalities.

Use appropriately the following evaluations that may have specific application to neonatal care:

1. Serologic and other studies for transplacental infection
2. Direct and indirect Coomb's tests
3. Neonatal drug screening
4. Cranial ultrasound for intraventricular hemorrhage
5. Abdominal X-rays for placement of umbilical catheter
6. Chest X-rays for endotracheal tube placement, air leak, heart size, and vascularity

Use appropriately the following laboratory tests when indicated for patients in the neonatal intensive care setting:

1. CBC with differential, platelet count, RBC indices
2. Blood chemistries: electrolytes, glucose, calcium, magnesium, phosphate
3. Renal function tests
4. Tests of hepatic function (PT, albumin) and damage (liver enzymes, bilirubin)
5. Serologic tests for infection (e.g., hepatitis, HIV)
6. CRP, ESR
7. Therapeutic drug concentrations
8. Coagulation studies: platelets, PT/PTT, fibrinogen, fibrin split products, D-dimers, DIC screen
9. Arterial, capillary, and venous blood gases
10. Detection of bacterial, viral, and fungal pathogens
11. Urinalysis
12. CSF analysis
13. Gram stain
14. Stool studies
15. Toxicologic screens/drug levels
16. Other fluid studies (e.g., pleural fluid, joint fluid)

## 17. Newborn screening tests

Appropriately use the following imaging or radiographic or other studies when indicated for patients in the NICU setting:

1. Chest X-ray
2. Abdominal series
3. Skeletal survey
4. CT scans
5. MRI
6. Nuclear medicine scans
7. Electrocardiogram and echocardiogram
8. Cranial ultrasonography

**GOAL: Monitoring and Therapeutic Modalities. Understand how to use the physiologic monitoring, special technology and therapeutic modalities used commonly in the care of the fetus and newborn.**

Demonstrate understanding of the monitoring techniques and special treatments commonly used in the NICU by being able to:

1. Discuss the indications, contraindications and complications.
2. Describe the general technique for use in infants.
3. Interpret the results of monitoring.

Use appropriately the following monitoring and therapeutic techniques in NICU.

1. Physiologic monitoring of temperature, pulse, respiration, blood pressure
2. Pulse oximetry
3. Neonatal pain and drug withdrawal scales

Demonstrate understanding of the following techniques and procedures used by obstetricians and perinatal specialists:

1. Fetal ultrasound for size and anatomy
2. Fetal heart rate monitors
3. Scalp and cord blood sampling
4. Amniocentesis
5. Cardiocentesis
6. Intrauterine transfusion including exchange transfusions
7. Chorionic villus sampling

Use appropriately the following treatments and techniques in the neonatal intensive care unit under supervision by the attending neonatologist, monitoring effects and anticipating potential complications specific to each procedure. (The degree of supervision should take into consideration the skill required, acuity of the patient, and relative risk of the procedure.)

1. Oxygen administration by hood, CPAP or assisted ventilation
2. Endotracheal intubation
3. Administration of surfactant therapy
4. Positive pressure ventilation and basic ventilator management
5. Extracorporeal membrane oxygenation/nitric oxide therapy

6. Phototherapy
7. Umbilical arterial and venous catheterization
8. Central hyperalimentation and parenteral nutrition
9. Enteral nutrition
10. Analgesic, sedatives and paralytics
11. Blood and blood product transfusions, including exchange transfusion
12. Vasoactive drugs (pressors and inotropes)
13. Judicious use of antibiotics
14. Administration of medications specific to the needs of the newborn (e.g., Vitamin K)
15. Arterial puncture
16. Venous access by peripheral vein
17. Umbilical artery and vein catheterization
18. Chest tube placement
19. Paracentesis

Describe home medical equipment and services needed for oxygen-dependent and technology-dependent graduates of the NICU (oxygen, apnea monitor, ventilator, home hyperalimentation, etc.).

Use appropriate resources to facilitate the transition to home of the technology-dependent neonate.

4.24.7 : Guide mothers in the use of electric and manual breast pumps.

**GOAL: Pediatric Competencies: Demonstrate high standards of professional competence while working with patients in the Neonatal Intensive Care Unit.**

**Competency 1: Patient Care.** Provide family-centered patient care that is development- and age-appropriate, compassionate, and effective for the treatment of health problems and the promotion of health.

1. Use a logical and appropriate approach to the assessment and daily management of seriously ill neonates and their families, under the guidance of a neonatologist, using evidence-based decision-making and problem-solving skills.

2. Provide emotional, social, and culturally sensitive support to families of NICU infants, including those at home.

**Competency 2: Medical Knowledge.** Understand the scope of established and evolving biomedical, clinical, epidemiological and social-behavioral knowledge needed by a pediatrician; demonstrate the ability to acquire, critically interpret and apply this knowledge in patient care.

1. Demonstrate a commitment to acquiring the knowledge base expected of general pediatricians caring for seriously ill neonates under the guidance of a neonatologist.

2. Know and/or access medical information efficiently, evaluate it critically, and apply it appropriately to the care of ill newborns

**Competency 3: Interpersonal Skills and Communication.** Demonstrate interpersonal and communication skills that result in information exchange and partnering with patients, their families and professional associates.

1. Provide effective and sensitive communication with families of infants

in the NICU setting.
2. Function effectively as part of an interdisciplinary team member in the NICU to create and sustain information exchange and teamwork for patient care.
3. Maintain accurate, timely, and legally appropriate medical records in the critical care setting of the NICU.
<b>Competency 4: Practice-based Learning and Improvement.</b> Demonstrate knowledge, skills and attitudes needed for continuous self-assessment, using scientific methods and evidence to investigate, evaluate, and improve one's patient care practice.
1. Use scientific methods and evidence to investigate, evaluate, and improve one's patient care practice in NICU setting.
2. Identify personal learning needs, systematically organize relevant information resources for future reference, and plan for continuing acquisition of knowledge and skills.
<b>Competency 5: Professionalism.</b> Demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles and sensitivity to diversity.
1. Demonstrate a commitment to carrying out professional responsibilities while providing care in the NICU setting.
2. Adhere to ethical and legal principles, and be sensitive to diversity in caring for critically ill newborns.
<b>Competency 6: Systems-Based Practice.</b> Understand how to practice high-quality health care and advocate for patients within the context of the health care system.
1. Identify key aspects of health care systems, cost control and mechanisms for payment in the NICU setting.
2. Recognize the limits of one's knowledge and expertise and take steps to avoid medical errors.
<b>Level Specific Competencies</b>
<b><u>First Year (PL-1)</u></b>
<b><u>Patient Care:</u></b>
<ol style="list-style-type: none"> <li>1. Prioritizes a patient's problems</li> <li>2. Prioritizes a day of work</li> <li>3. Gathers essential/accurate information via interviews and physical exams in a manner that is respectful of patients and families</li> <li>4. Can provide an organized and precise patient presentation</li> <li>5. Works with all health care professionals to provide family centered care</li> <li>6. Competently understands/performs/interprets procedures: <ol style="list-style-type: none"> <li>_____ Physiologic Monitoring: Cardiac, Resp, and Oximetry</li> <li>_____ Capillary Blood Collection</li> <li>_____ Neonatal Resuscitation (as team member)</li> <li>_____ Use/Care of Central Lines (PICC/Umbilical Lines)</li> <li>_____ Conjunctival Swab</li> </ol> </li> </ol>

- \_\_\_\_\_ Lumbar Puncture
- \_\_\_\_\_ Umbilical Line Placement (attempts)
- \_\_\_\_\_ Endotracheal Intubation (attempts)
- \_\_\_\_\_ NG/OG tube placement
- \_\_\_\_\_ Inguinal Hernia (simple reduction)
- \_\_\_\_\_ Breast Pump Use
- \_\_\_\_\_ Modes of Ventilation
- \_\_\_\_\_ Initiation of TPN

**Medical Knowledge:**

1. Uses written and electronic references and literature to learn about patient diseases
2. Demonstrates knowledge of basic and clinical sciences
3. Applies knowledge to therapy

**Interpersonal Skills and Communication:**

1. Writes pertinent and organized notes
2. Updates and maintains the ongoing patient data sheets
3. Uses effective listening, narrative, and non-verbal skills to elicit and provide information
4. Works effectively as a member of the health care team

**Practice-based Learning and Improvement:**

1. Understands his or her limitations of knowledge
2. Asks for help when needed
3. Is self motivated to acquire knowledge
4. Accepts feedback and develops self-improvement plans

**Professionalism:**

1. Is honest, reliable, cooperative, and accepts responsibility
2. Shows regard for opinions and skills of colleagues
3. Is responsive to needs of patients and society, which supersedes self-interest
4. Acknowledges errors and works to minimize them

**Systems Based Practice:**

1. Is a patient advocate
2. Works within the system based model to optimized and ensure quality patient care

## **Second Year (PL-2)**

**Patient Care:**

1. Understands and weighs alternatives for diagnosis and treatment
2. Elicits subtle findings on physical examination
3. Is able to manage multiple problems at once
4. Develops and carries out management plans
5. Competently understands/performs/interprets procedures:
  - \_\_\_\_\_ Physiologic Monitoring: Cardiac, Resp, and Oximetry
  - \_\_\_\_\_ Capillary Blood Collection
  - \_\_\_\_\_ Neonatal Resuscitation (as team leader)
  - \_\_\_\_\_ Use/Care of Central Lines (PICC/Umbilical Lines)
  - \_\_\_\_\_ Conjunctival Swab
  - \_\_\_\_\_ Lumbar Puncture
  - \_\_\_\_\_ Umbilical Line Placement (some successful)
  - \_\_\_\_\_ Endotracheal Intubation (some successful)
  - \_\_\_\_\_ NG/OG tube placement



- \_\_\_\_\_ Inguinal Hernia (simple reduction)
- \_\_\_\_\_ Breast Pump Use
- \_\_\_\_\_ Radiology Interpretation: AXR, CXR
- \_\_\_\_\_ Arterial Puncture
- \_\_\_\_\_ Initiation of Mechanical Ventilation
- \_\_\_\_\_ Modes of Ventilation (NCPAP, HFOV, Conventional)
- \_\_\_\_\_ Initiation/Ongoing management of TPN
- \_\_\_\_\_ Thoracentesis

**Medical Knowledge:**

1. Is aware of indications, contraindications, and risks of commonly used medications and procedures in NICU
2. Applies the basic, clinical, epidemiologic, and social-behavioral science knowledge to the care of the patient

**Interpersonal Skills and Communication:**

1. Creates and sustains therapeutic and ethically sound relationships with patients and families
2. Provides education and counseling to patients, families, and colleagues
3. Works effectively as a member of the health care team

**Practice-based Learning and Improvement:**

1. Undertakes self-evaluation with insight and initiative
2. Facilitates the learning of students and other health care professionals

**Professionalism:**

1. Displays initiative and leadership
2. Is able to delegate responsibility to others
3. Is responsive to needs of patients and society, which supersedes self-interest

**Systems Based Practice:**

1. Applies knowledge of how to partner with health care providers to assess, coordinate and improve patient care
2. Uses systematic approach to reduce errors

## **Third Year (PL-3)**

**Patient Care:**

1. Makes informed decisions about diagnosis and therapy after analyzing clinical data
2. Includes the family when making medical decisions
3. Reasons well in ambiguous situations
4. Spends time appropriate to the complexity of the problem
5. Competently understands/performs/interprets procedures:
  - \_\_\_\_\_ Physiologic Monitor: Cardiac, Resp, and Oximetry
  - \_\_\_\_\_ Capillary Blood Collection
  - \_\_\_\_\_ Neonatal Resuscitation (as team leader)
  - \_\_\_\_\_ Use/Care of Central Lines (PICC/Umbilical Lines)
  - \_\_\_\_\_ Conjunctival Swab
  - \_\_\_\_\_ Lumbar Puncture
  - \_\_\_\_\_ Umbilical Line Placement (mostly successful)
  - \_\_\_\_\_ Endotracheal Intubation (mostly successful)
  - \_\_\_\_\_ NG/OG tube placement

- \_\_\_\_\_ Inguinal Hernia (simple reduction)
- \_\_\_\_\_ Breast Pump Use
- \_\_\_\_\_ Radiology Interpretation: AXR, CXR, HUS
- \_\_\_\_\_ Arterial Puncture
- \_\_\_\_\_ Ongoing Management of Mechanical Ventilation
- \_\_\_\_\_ Modes of Ventilation (NCPAP, HFOV, Conventional)
- \_\_\_\_\_ Ongoing management of TPN
- \_\_\_\_\_ Thoracentesis
- \_\_\_\_\_ Chest Tube (understand need/management)
- \_\_\_\_\_ Independent and Competent at Resuscitation  
(Code Pink Status)

**Medical Knowledge:**

1. Is aware of indications, contraindications, and risks of commonly used medications and procedures in the NICU
2. Demonstrates an investigatory and analytic approach to clinical situations

**Interpersonal Skills and Communication:**

1. Creates and sustains therapeutic and ethically sound relationships with patients and families
2. Provides education and counseling to patients, families, and colleagues
3. Works effectively as a member of the health care team

**Practice-based Learning and Improvement:**

1. Analyzes personal practice patterns and looks to improve
2. Compares personal practice patterns to larger populations
3. Facilitates the learning of students and other health care professionals

**Professionalism:**

1. Demonstrates commitment to on-going professional development
2. Is effective as a consultant
3. Is responsive to needs of patients and society, which supersedes self-interest

**Systems Based Practice:**

1. Demonstrates ability to adapt to change
2. Provides cost effective care
3. Practices effective allocation of health care resources that does not compromise the quality of care

**References:**

1. American Board of Pediatrics, Content Specification, 2007
2. Ambulatory Pediatric Association
3. Association of Pediatric Program Directors
4. Pediatric RRC, January 2006