

# UNIVERSITY OF MINNESOTA MEDICAL CENTER - FAIRVIEW NEONATAL INTENSIVE CARE UNIT (NICU-F4) CURRICULUM

## DESCRIPTION OF ROTATION OR EDUCATIONAL EXPERIENCE

Clinical rotation on major tertiary/quaternary University neonatal intensive care unit. Pediatric critical care fellow has responsibility to perform as a neonatal fellow to provide clinical care and coordination of care for all patients admitted to the NICU as well as consultations on other services for stabilization and/or transfer to the NICU.

## ROTATION GOALS

Clinical experience will facilitate knowledge acquisition regarding the physiology, pathophysiology, pharmacology, and literature evidence for all determinants and phases of critical illness in the neonate, culminating in the application of that knowledge to the compassionate, age appropriate, and effective management of neonates with single organ to multiple organ system failure

## PATIENT CARE

### Goals

1. Acquisition of knowledge regarding established and evolving biomedical, clinical, and cognate sciences, with the resultant application of that knowledge to the compassionate, age appropriate, and effective treatment of critically ill neonates.
2. Comprehensive knowledge of the physiology, pathophysiology, pharmacology, and literature evidence for all determinants and phases of critical illness, culminating in excellence in the clinical management of neonatal with single organ to multiple organ system failure.

### Objectives

#### *1. Knowledge acquisition and performance development:*

1. Expand understanding of physiology, pathophysiology and therapy of neonatal disorders beyond that of a senior resident so as to have a thorough grasp on the basic normal physiology and the mechanisms organ systems use to cope with physiologic derangements and stress.
2. Be skilled in physical examination and medical history taking as related to neonatal critical care medicine.
3. Be able to apply basic neonatal critical care physiology and pathophysiology to patient care.
4. Understand tools and instruments used for monitoring patients in the NICU and be able to access and interpret the necessary data.
5. Develop understanding of therapeutic options and apply current literature to neonatal patient care.
6. Be able to stabilize a critically ill neonate during initial presentation of respiratory distress, inborn error of metabolism, congenital heart disease, renal failure, congenital defects, surgical emergencies or other multiple, complex problems, including:
  - Establish differential diagnosis, assessment and plan
  - Prioritize interventions effectively
  - Act in a timely fashion as clinical situation warrants
7. Order and interpret diagnostic tests appropriately.
8. Provide complex neonatal nutritional support, both enteral and parenteral, including an understanding of breast feeding and lactation.
9. Learn to use consultants effectively.
10. Maintain appropriate documentation of patient care.
11. Effectively supervise residents and contribute to their medical education.
12. Understand indications and risk/benefits to procedures for which training and proficiency is accomplished, and maintain procedure logs:
  - Cardiopulmonary resuscitation
  - Delivery room resuscitation
  - Conscious sedation
  - Non-invasive airway management

- Endotracheal intubation
- Tube thoracostomy and thoracentesis
- Arterial line placement
- Central venous catheter placement
- ECMO management

This clinical and technical skills progression should include the following curriculum components more thoroughly outlined in “Medical Knowledge”:

- a. Resuscitation and Stabilization.
- b. Information Gathering.
- c. Cognitive Skills by System:
  - Cardiovascular
  - Respiratory
  - Renal
  - Central Nervous System
  - Endocrinology
  - Infectious Disease
  - Hematology/Oncology
  - Gastrointestinal
  - Nutrition and Metabolism
  - Pain, Analgesia and Sedation

2. *Acquisition of procedural skills as follows:*

1. Understand the anatomic considerations, correct techniques, indications/contraindications, and potential complications for all clinical procedures required for the superlative care of critically ill neonates.
2. Expertly and independently perform appropriate procedures based on skill level and level of clinical training:
  - Procedures that may be performed independently, but ideally with attending physician supervision:
    - Arterial Puncture
    - Lumbar Puncture
    - Peripheral Vein Cannulation
    - Umbilical Vein Cannulation
    - Umbilical Artery Cannulation
  - Procedures that require approval from the attending physician prior to being performed independently but ideally with attending physician supervision:
    - Femoral Vein Cannulation
    - Femoral Artery Cannulation
    - Axillary Artery Cannulation
    - Endotracheal Intubation
    - Thoracentesis
    - Thoracostomy Tube Placement
    - Peripheral Artery Cannulation
    - Peritoneocentesis
    - Procedural Sedation
    - PICC placement
  - Procedures that usually require direct attending supervision and participation:
    - Subclavian Vein Cannulation
    - Internal Jugular Vein Cannulation
    - Pulmonary Artery Catheter Insertion
    - Dialysis Catheter Insertion
    - Pericardiocentesis

3. *Management and decision-making:*
  1. Discuss the indications for admission to and discharge from the Neonatal Intensive Care Unit, including indications for emergent intervention and stabilization prior to transport to the NICU.
  2. Develop and maintain a detailed list of specific patient-related responsibilities with accurate execution and prioritization.
  3. Coordinate care of the NICU patient with the neonatal attendings, consultants, ancillary services, and primary care physicians.
  4. Coordinate orderly transfer of care to another health care provider when NICU care is no longer required or when transfer to a different care site is warranted.
  5. Recognize the limits of one's knowledge, skills, and tolerance for stress.
  
4. *PICU fellow responsibilities while on F4 will include:*
  1. Overseeing the clinical activities of the rotating Pediatric Residents.
  2. Direct patient care in consultation with the Senior NICU Fellow.
  3. Notifying the Senior NICU Fellow/ Faculty regarding major changes in the clinical status of any patient in the PICU.
  4. Reviewing, evaluating, and triaging referrals from the Emergency Department, Post-anesthesia Care Unit (PACU), delivery room and newborn nursery areas. All patients who are evaluated, but not transferred to the NICU require a note in the medical chart outlining recommendations from the Neonatal Care Service.

#### Competencies

1. Neonatal Medicine Faculty Evaluation (See Faculty Evaluation Form, Appendix A).
2. Neonatal Intensive Care Unit Staff 360 Evaluation (See Staff 360 Evaluation Form, Appendix C).
3. Parent 360 Evaluation (See Parent 360 Evaluation Form, Appendix xx).
4. Resident Evaluation of Fellow (See Appendix XX).
5. Multiple Choice Examinations: Each year of training, the Critical Care Medicine Subspecialty Resident will be required to participate in the American Board of Pediatrics In-service Subspecialty Exam and the Society of Critical Care Medicine's Multidisciplinary Critical Care Knowledge Assessment Program (MCKAP).
6. Pediatric Advanced Life Support (PALS) Certification: Training and maintaining certification in PALS (American Heart Association) is a requirement of Critical Care Medicine Subspecialty Resident training.
7. Neonatal Resuscitation Program Certification.
7. Procedural Skills Documentation (See Procedure Log, Appendix B).
8. Participation in the required Clinical Curriculum as outlined above.

### **MEDICAL KNOWLEDGE**

#### Goals

1. Perpetual acquisition of knowledge regarding established and evolving biomedical, clinical, and cognate sciences, with the resultant application of that knowledge to the compassionate, age appropriate, and effective treatment of critically ill neonates.
2. Comprehensive knowledge of the physiology, pathophysiology, pharmacology, and literature evidence for all determinants and phases of critical illness, culminating in excellence in the clinical management of neonates with single organ to multiple organ system failure.

#### Objectives

Expand understanding of physiology, pathophysiology and therapy of disorders beyond that of a senior resident so as to have a thorough grasp on the basic normal physiology and the mechanisms organ systems use to cope with neonatal physiologic derangements and stress.

Medical Knowledge curriculum components are included below as follows:

a. Resuscitation and Stabilization:

- Promptly recognize clinical signs and symptoms heralding the onset of life-threatening events.
- Expeditiously and appropriately intervene to prevent the onset of cardiopulmonary arrest.
- Thoroughly understand the basic principles of NRP, cardiopulmonary resuscitation and stabilization.
- Perform appropriately as the critical care team leader during cardiopulmonary resuscitation and stabilization.
- Recognize the pathophysiology associated with tissue hypoxia/ischemia and properly institute medical management to minimize secondary injury.

b. Information Gathering:

- Perform an appropriately detailed problem-oriented history and physical examination.
- Assimilate, organize, and succinctly summarize all pertinent previously obtained medical information from the Delivery Room, Operating Room or Emergency Department, newborn nursery, outside hospital, and/or clinic.
- Informatively discriminate diagnostic interventions based upon parent/patient information, previous medical information, patient and family preference, scientific evidence, and clinical judgment.
- Discuss the indications, limitations, and risks of diagnostic studies and interpret abnormalities in the context of disease-specific pathophysiology.
- Formulate an age-appropriate differential diagnosis with appropriate prioritization.
- Expeditiously utilize all diagnostic information in the development, execution, and evolution of logical, effective therapeutic management strategies.

c. Cognitive Skills:

*THE CARDIOVASCULAR SYSTEM:*

- Utilize principles of physiology, pathophysiology, pharmacology, and evidence-based medicine to recognize signs and symptoms of, and expeditiously and logically diagnose and treat the following conditions:
  - Congenital heart disease
  - Cardiogenic Shock
  - Congestive Heart Failure
  - Cardiac Tamponade
  - Hypertension
  - Hypotension
  - Dysrhythmia
- Accurately perform calculations, interpretation, and utilization of hemodynamic data in the management of patients with hemodynamic instability.
- Appropriately utilize inotropes, vasoconstrictors, and vasodilators, and thoroughly understand the pharmacological actions, uses, and indications/contraindications for each.

**Box 1: Congenital Heart Diseases**

- Tricuspid Atresia
- Ebstein's Anomaly
- Double Outlet Right Ventricle
- Pulmonary Stenosis/Pulmonary Atresia
- Anomalous Pulmonary Venous Return
- Mitral Stenosis/Mitral Atresia
- Double Inlet Left Ventricle
- Hypoplastic Left Heart Syndrome
- Aortic Stenosis
- Aortic Coarctation/Interrupted Aortic Arch
- Atrial Septal Defect
- Ventricular Septal Defect
- Atrioventricular Canal Defect
- Truncus Arteriosus
- Transposition of the Great Arteries
- Tetralogy of Fallot

- Thoroughly understand cardiopulmonary interactions and the effects of positive pressure mechanical ventilation on cardiovascular function.
- Understand the basic principles and associated acute effects of extracorporeal circulation (ECMO) on organ function
- Generally understand the embryology and anatomy of the principle types of congenital heart disease (Box 1) and the consequent acute and chronic circulatory pathophysiology associated with each.
- Understand the potential general and procedure-specific complications encountered prior to surgery for congenital heart disease and apply appropriate intervention and stabilization strategies

*THE RESPIRATORY SYSTEM:*

- Utilize principles of physiology, pathophysiology, pharmacology and evidence based medicine to recognize signs and symptoms of, and expediently and logically treat the following conditions:
  - Neonatal Respiratory Distress Syndrome
  - Meconium Aspiration
  - Pneumonia
  - Pneumonitis (infectious, aspiration)
  - Upper Airway Obstruction (anatomic, infectious)
  - Bronchiolitis
  - Bronchopulmonary Dysplasia/Chronic Lung Disease
  - All Other Forms of Acute Respiratory Failure
- Utilize appropriate timing, techniques, and tools in emergency airway management.
- Accurately interpret and utilize arterial/venous blood gas data in the management of patients with respiratory dysfunction.
- Accurately interpret chest x-ray abnormalities in the context of disease-specific pathophysiology, and formulate a plan for therapeutic intervention when appropriate.
- Comprehensively understand (1) the indications for endotracheal intubation, (2) the general principles of mechanical ventilation of the neonate, (3) the various modes of mechanical ventilation, (4) the differential management of obstructive versus restrictive lung diseases, (5) the pathophysiological mechanisms leading to the development of ventilator-induced lung injury (barotrauma, volutrauma, biotrauma), (6) the disease-specific principles of weaning from mechanical ventilation and (7) the criteria for the appropriate implementation of extracorporeal membrane oxygenation (ECMO).

*THE RENAL SYSTEM:*

- Utilize principles of physiology, pathophysiology, pharmacology, and evidence-based medicine to recognize the signs and symptoms of, and expediently and logically treat acute renal failure.
- Thoroughly understand the normal renal mechanisms of fluid and electrolyte homeostasis.
- Appropriately utilize serum and urine electrolytes to determine the pathophysiological mechanisms associated with alterations in fluid and electrolyte homeostasis.
- Thoroughly understand the normal renal mechanisms of acid/base homeostasis.
- Thoroughly understand the general principles of, indications for, and advantages/disadvantages to the utilization of hemodialysis, peritoneal dialysis, and continuous venovenous hemofiltration (CVVH).

*THE CENTRAL NERVOUS SYSTEM:*

- Utilize principles of physiology, pathophysiology, pharmacology, and evidence-based medicine to recognize signs and symptoms of, and expediently and logically treat the following conditions:
  - Hypoxic ischemic encephalopathy
  - Status Epilepticus
  - Encephalopathy/Coma
  - Intracranial Hypertension
  - Intracranial Hemorrhage, including Intraventricular Hemorrhage
  - Spinal Cord Injury
  - Neuromuscular Disease

*THE ENDOCRINE SYSTEM:*

- Utilize principles of physiology, pathophysiology, pharmacology, and evidence-based medicine to recognize signs and symptoms of, and expediently and logically treat the following conditions:
  - Hyperglycemia
  - Hypoglycemia
  - Syndrome of Inappropriate Antidiuretic Hormone (SIADH)
  - Diabetes Insipidus (DI)
  - Congenital Adrenal Hyperplasia
  - Adrenal Crisis/Insufficiency
  - Thyrotoxicosis/Thyroid Storm
  - Hypothyroidism

*INFECTIOUS DISEASES:*

- Utilize principles of pathophysiology, pharmacology, and evidence-based medicine to recognize signs and symptoms of, and expediently and logically treat the following conditions:
  - Sepsis/ Sepsic Shock
  - Meningitis
  - Encephalitis
  - Pneumonia
  - Bronchiolitis
  - Endocarditis
  - Myocarditis
  - Pericarditis
  - Pyelonephritis
  - Peritonitis
- Thoroughly understand the epidemiology and risk factors associated with the development of nosocomial infections in critically ill neonates.
- Thoroughly understand the principles of infection control within the Neonatal Intensive Care Unit.

*THE HEMATOLOGICAL SYSTEM:*

- Utilize the principles of physiology, pathophysiology, pharmacology, and evidence-based medicine to recognize signs and symptoms of, and expediently and logically treat the following conditions:
  - Disseminated Intravascular Coagulation
  - Anemia
  - Hemorrhage
  - Thrombocytopenia
  - Coagulopathy
  - Thrombosis
  - Hemolysis

Congenital Hemoglobinopathy, Leukopenia, Thrombocytopenia or Marrow Failure Syndrome

- Thoroughly understand the indications, risks, and benefits associated with blood component transfusion including exchange transfusion

THE GASTROINTESTINAL SYSTEM:

- Utilize principles of physiology, pathophysiology, pharmacology, and evidence-based medicine to recognize signs and symptoms of, and expediently and logically treat the following conditions:

Gastrointestinal Bleeding  
Acute Hepatic Failure  
Pancreatitis  
Viscus Perforation  
Necrotizing Enterocolitis  
Gastrointestinal Obstruction, including Medonium Ileus  
Congenital Anatomic Abnormalities

*NUTRITION AND METABOLISM:*

- Utilize principles of physiology, pathophysiology, pharmacology, and evidence-based medicine to recognize signs and symptoms of, and expediently and logically treat inborn errors of metabolism that produce critical illness.
- Understand the effect of stress, altered substrate utilization, energy requirements, and the indications, risks and benefits of various modes of nutritional support in the critically ill neonate.

Understand the role/benefits of breast feeding and options to provide nutrition in the neonate unable to nurse.

*IMMUNOLOGY*

- Generally classify the congenital immunodeficiency disorders as primarily affecting immunoglobulins, T-cell function, both B- and T-cell function, or the phagocytic system, and recognize the general presenting signs and symptoms associated with each.
- Generally understand the potential opportunistic organisms associated with infection in inherited and acquired disorders of immune function.

*SEDATION, ANALGESIA, AND MUSCLE RELAXATION:*

- Generally understand and have a working knowledge of the pharmacokinetics, mechanisms of action, pharmacodynamics, contraindications, side effects, and potential complications for each of the commonly used sedatives, analgesics, and muscle relaxants in the NICU. (Box #2).

**Box #2: Commonly Used Sedatives, Analgesics, and Muscle Relaxants:**

**SEDATIVES:**

**Benzodiazepines:**

Midazolam (Versed)

Lorazepam (Ativan)

**Barbiturates:**

Thiopental

Pentobarbital

Phenobarbital

Propofol

Chloral Hydrate

**ANALGESICS:**

**Narcotics:**

Morphine

Fentanyl

**Non-steroidal Antiinflammatory Drugs:**

Ibuprofen

Acetaminophen

**MUSCLE RELAXANTS:**

**Non-depolarizing:**

Vecuronium (Norcuron)

Atracurium

Rocuronium

Pancuronium

**Depolarizing:**

Succinylcholine

Competencies

1. Neonatal Critical Care Medicine Faculty Evaluation (See Faculty Evaluation Form, Appendix A).
2. Multiple Choice Examinations: Each year of training, the Critical Care Medicine Subspecialty Resident will be required to participate in the American Board of Pediatrics In-service Subspecialty Exam and the Society of Critical Care Medicine's Multidisciplinary Critical Care Knowledge Assessment Program (MCKAP).
3. NRP certification.
4. Procedural Skills Documentation (See Procedure Log, Appendix B).
5. Participation in the required Clinical Curriculum as outlined above.
6. Participation in required Departmental Core Curriculum for Subspecialty Residents.
7. Participation in ECMO course.

**PRACTICE-BASED LEARNING AND IMPROVEMENT**

Goals

To acquire skills to enable investigation and evaluation of patient care practices, appraisal and assimilation of scientific evidence, and improvement of patient care practices.

Objectives

1. Analyze one's practice experience, recognizing strengths, deficiencies, and knowledge limits; perform practice-based improvement activities using a systematic methodology.
2. Consider and utilize performance evaluations from peers, attendings, patients, parents, nurses, respiratory therapists, and other ancillary health care providers for clinical performance improvement in the care of critically ill children.
3. Locate, appraise, and assimilate evidence from scientific studies directly related to the management of critically ill children
4. Procure and utilize information relative to critically ill children and the larger population from which these patients are drawn
5. Appraise study designs and statistical methods of clinical studies that demonstrate diagnostic or therapeutic effectiveness

6. Utilize information technology to access and manage medical information
7. Facilitate the education of residents, students, and other health care professionals.

#### Competencies

1. Neonatal Medicine Faculty Evaluation (See Evaluation Form, Appendix A).
2. Participation in the required Clinical Curriculum Rounds and Conferences as outlined above.
3. Participation in practice-based learning and improvement that involves investigation and evaluation of fellow's individual patient care by presenting Case Presentations and Morbidity and Mortality at Divisional Conference as outlined.
4. Participation in Health Team Rounds.
5. Facilitating teaching and learning of students and other health care providers by leading teaching during patient care rounds .

#### **SYSTEMS BASED PRACTICE**

##### Goals

Achieve cognisant responsiveness to the larger context of the health care system and the effective employment of system resources to provide care that is of optimal value.

##### Objectives

1. Understand the effect of patient management decisions and professional practices upon other health care professionals, the health care organization, and the larger society.
2. Appreciate the differences in medical practice and health care delivery systems, and their effect upon medical management.
3. Practice cost-effective health care and resource allocation while maintaining an uncompromised quality of care.
4. Advocate for quality patient care and assist patients in dealing with system complexities.
5. Partner with health care managers and health care providers to assess, coordinate, and improve health care and system performance.
6. Acknowledge medical errors and assist in developing or improving systems for their prevention.

#### Competencies

1. Neonatal Critical Care Medicine Faculty Evaluation (See Faculty Evaluation Form, Appendix A).
2. Neonatal Intensive Care Unit Staff 360 Evaluation (See Staff 360 Evaluation Form, Appendix C).
3. Parent 360 Evaluation.

#### **PROFESSIONALISM**

##### Goals

Commitment to executing professional responsibilities, adherence to ethical principles, and sensitivity to diverse populations.

##### Objectives

1. Demonstrate respect, compassion, integrity, honesty, compassion, and empathy.
2. Respond to the needs of patients and society in a benevolent manner that supersedes self-interest.
3. Demonstrate accountability to patients, society, and the profession.
4. Commit to consistently performing professional responsibilities, including complete medical records.
5. Demonstrate HIPPA compliance.
6. Participate in program requirements in clinical, research and educational curricula.
7. Commit to excellence and continuing professional development.

8. Commit to ethical principles pertaining to provision, withholding, or withdrawal of clinical care, patient confidentiality, informed consent, and clinical practices.
9. Demonstrate sensitivity and responsiveness to patients' and colleagues' culture, age, gender, beliefs, and disabilities.
10. Present oneself in professional manner, both in behavior and dress.
11. Submit fellowship paperwork in a timely fashion.

Competencies

1. Neonatal Critical Care Medicine Faculty Evaluation (See Evaluation Form, Appendix A).
2. Neonatal Intensive Care Unit Staff 360 Evaluation (See Evaluation Form, Appendix C).
3. Neonatal Intensive Care Unit Parent 360 Evaluation (See Parent 360 Form, Appendix D).
4. Professionalism Evaluation Form (See Professionalism Evaluation Form, Appendix XX).
4. Successful completion of HIPPA training through Human Subjects Committee.
5. Timely submission of fellowship duty hours, evaluations and procedure logs.
6. Complete "Leadership Curriculum", currently being developed.

**INTERPERSONAL AND COMMUNICATION SKILLS**

Goals

Development of interpersonal and communication skills resulting in effective information exchange and collaboration with patients, families, and health care professionals.

Objectives

1. Develop and maintain a therapeutic and ethically appropriate relationship with patients and their families.
2. Listen effectively.
3. Elicit and provide information using effective nonverbal, informative, interrogative, and writing skills.
4. Communicate and work effectively with other fellows, residents, attendings, consultants, nurses and ancillary health care providers as a member of the critical care medicine team.
5. Communicate effectively with surgeons and other subspecialists whose patients are being managed in the Neonatal Intensive Care Unit.
6. Assume responsibility for frequent and effective communication with referring and primary care physicians whose patients are being managed in the NICU.
7. Consistently maintain accurate, timely, and legally appropriate medical records.

Competencies

1. Neonatal Care Medicine Faculty Evaluation (See Evaluation Form, Appendix A).
2. Neonatal Intensive Care Unit Staff 360 Evaluation (See Evaluation Form, Appendix C).
3. Neonatal Intensive Care Unit Parent 360 Evaluation (See Parent 360 Form, Appendix D).
4. Attendance at Cardiology conferences when on service.
5. Presentation of Morbidity and Mortality case at Divisional Conference.
6. Complete compliance with procedure note documentation.

**TEACHING METHOD(S)**

Didactic teaching on rounds.

Graduated levels of direct supervision of triage, decision making, etc.

Conference schedule (outlined elsewhere).

Procedure-based courses, including Pediatric Advanced Life Support (PALS), extra-corporeal membrane oxygenation (ECMO) course.

**ASSESSMENT METHOD - RESIDENT(S)**

Quarterly performance evaluations.

**ASSESSMENT METHOD – ROTATION**

The fellows provide an anonymous review of the rotation, including comment on patient volume, quality of supervision and overall value of rotation.

The fellows provide an anonymous overall program review biannually and participate in Divisional discussion of the reviews and remediation planning.

**LEVEL OF SUPERVISION**

The fellow is directly supervised by pediatric critical care faculty, more senior fellows or other pediatric subspecialty faculty with graduated levels of independent decision making, as noted above. However, ALL of the above fellow responsibilities are to be performed only under the direct leadership, knowledge, and approval of the Neonatal Critical Care Medicine Attending Physician.

**EDUCATIONAL RESOURCES**

Resident library.

Conference schedule.

Didactic courses.

Web-based educational sites.

NeoReviews.