The chart shows the percentage distribution of questions on the Care of the Extremely Low Birth Weight Neonate exam across the major content categories covered on the examination.
## EXAM OUTLINE

Areas of knowledge to be tested on the Care of the Extremely Low Birth Weight Neonate examination are listed in the following outline. This list is not intended as an all-inclusive review. It is provided only to help candidates evaluate their own practice.

Percentages identified for the topic areas represent the number of test questions assigned to each content area. These percentages do not necessarily reflect the content of future examinations.

<table>
<thead>
<tr>
<th>10.00</th>
<th>General Assessment and Management (28%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Physical, Gestational Age, Behavioral and Neurologic Assessment</td>
<td></td>
</tr>
<tr>
<td>• Delivery Room Management, Stabilization and Transition</td>
<td></td>
</tr>
<tr>
<td>• Transport/Transfer</td>
<td></td>
</tr>
<tr>
<td>• Thermoregulation</td>
<td></td>
</tr>
<tr>
<td>• Fluid and Electrolytes</td>
<td></td>
</tr>
<tr>
<td>• Nutrition and Feeding</td>
<td></td>
</tr>
<tr>
<td>• Respiratory Management/Oxygenation (e.g. Blood gases, Ventilation)</td>
<td></td>
</tr>
<tr>
<td>• Skin Care</td>
<td></td>
</tr>
<tr>
<td>• Infection Risks (immaturity, prevention, bundles)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>11.00</th>
<th>Developmental Care (18%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Neurodevelopment (Structure, function, immaturity)</td>
<td></td>
</tr>
<tr>
<td>• Impact of NICU Environment</td>
<td></td>
</tr>
<tr>
<td>• Neuroprotective Intentional Caregiving and Promotion of Self-regulation</td>
<td></td>
</tr>
<tr>
<td>• Neurobehavioral Alterations and Responses (habituation, state and motor organization)</td>
<td></td>
</tr>
<tr>
<td>• Stress and Pain Assessment and Management</td>
<td></td>
</tr>
<tr>
<td>• Neuroprotection and Injury Prevention</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>12.00</th>
<th>Describe &amp; Manage Pathophysiologic States (39%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Perinatal Management, Maternal Risk Factors During Pregnancy and Obstetric Emergencies that Impact the ELBW neonate</td>
<td></td>
</tr>
<tr>
<td>• Cardiac</td>
<td></td>
</tr>
<tr>
<td>• Respiratory</td>
<td></td>
</tr>
<tr>
<td>• GI/GU</td>
<td></td>
</tr>
<tr>
<td>• Hematopoietic</td>
<td></td>
</tr>
<tr>
<td>• Infectious Diseases</td>
<td></td>
</tr>
<tr>
<td>• Metabolic/Endocrine/Genetic</td>
<td></td>
</tr>
<tr>
<td>• Neurologic, Neuromuscular, Skin and Musculoskeletal</td>
<td></td>
</tr>
<tr>
<td>• Renal</td>
<td></td>
</tr>
<tr>
<td>• Head, Eyes, Ears, Nose and Throat</td>
<td></td>
</tr>
<tr>
<td>• Pharmacology</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>13.00</th>
<th>Assess and Manage Psychosocial Behavioral States and Ethical Issues of the Family throughout Hospitalization and Discharge Utilizing Communication and Data to Improve Outcomes (15%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Family Integration</td>
<td></td>
</tr>
<tr>
<td>• Trauma Informed Care/Parental Coping and Grieving Process</td>
<td></td>
</tr>
<tr>
<td>• End of Life Care/Palliative Care, Viability and legal/ethical issues</td>
<td></td>
</tr>
<tr>
<td>• Discharge Planning, Teaching and Follow up</td>
<td></td>
</tr>
<tr>
<td>• Risks for motor, cognitive, language delays and expected milestones</td>
<td></td>
</tr>
<tr>
<td>• Professional Practice and Team Communication along the continuum of care</td>
<td></td>
</tr>
<tr>
<td>• EBP, QI, Research, Data Outcomes, Benchmarking</td>
<td></td>
</tr>
</tbody>
</table>
ASSOCIATED COMPETENCIES

- Identify maternal risk factors during pregnancy and the potential implications for the ELBW neonate.
- Systematically assess all body systems of the ELBW neonate utilizing physical examination, gestational age assessment and neurobehavioral assessment.
- Apply knowledge of anatomy and physiology (fetal, transitional, neonatal), pathophysiology, pharmacology, and behavioral psychology to assess the ELBW neonate and differentiate abnormal from normal.
- Recognize normal values and deviations in clinical laboratory and diagnostic data and identify potential significance for the ELBW neonate.
- Identify life-threatening states in the ELBW neonate and initiate appropriate, early intervention.
- Develop an individualized plan of care for the restoration, maintenance and promotion of health for the ELBW neonate and family unit during hospitalization and following discharge.
- Implement diagnostic, therapeutic and educational plans in collaboration with other health care providers to provide care for the ELBW neonate and family.
- Identify the vulnerabilities of the ELBW neonate across the continuum and implement strategies to reduce risks and optimize outcomes.
- Apply knowledge of local, state and national outcome data to guide families and direct clinical practice and quality improvement processes to optimize outcomes.
- Recognize the psychosocial impact and stressors related to the birth of an ELBW neonate in collaboration with the family.
- Identify professional, legal and ethical issues which impact the role of the health care provider in the care of ELBW neonate.
STUDY GUIDE

GENERAL ASSESSMENT AND MANAGEMENT

I. Physical, Gestational Age, Behavioral and Neurologic Assessment

- Normal/abnormal findings regarding: general appearance
- head, eyes, ears, neck (cartilage, recoil, fused eyes, eye prophylaxis, vitamin K)
- respiratory/Chest
- cardiovascular
- skin (immaturity, fragility)
- abdomen
- genitalia
- Normal/abnormal findings regarding:
- Physical and neuromuscular characteristics
- Associated risks
- Posture/Tone
- Movement
- Reflexes

II. Delivery Room Management, Stabilization and Transition

- Resuscitation (NRP)
  - initial evaluation
  - indications for ventilation and cardiac compressions
  - use of medications and volume expanders
- Timing of umbilical cord clamping
- Transition during umbilical cord clamping
  - initial resuscitation
- Thermoregulation
  - trans-epidural water loss
  - plastic wrap and hat
  - heat mattress
  - delivery room/OR temperature
- Ventilation strategies
  - CPAP
  - FiO₂
  - target oxygen saturation
- Surfactant
- Access
  - UVC
  - UAC
  - PIV
- Cleansing agents
- Fluid and electrolytes requirements at birth
  - dextrose and amino acid solution
  - total fluid goals
  - insensible water loss
  - weight
- Transport/transfer positioning and handling

III. Transport

- Thermoregulation
- Transfer

IV. Thermoregulation

- Mechanisms and management of heat loss/production
  - conduction
  - convection
  - evaporation
  - radiation
  - response to hypothermia and cold stress
  - response to hyperthermia
- Physiology of heat production
- Neutral thermal environment of the ELBW
  - humidification
  - environment
  - equipment

V. Fluid and Electrolytes

- Fluid status
  - normal body water composition
  - physiologic transition
  - renal function of the ELBW
  - urine output
  - acid base homeostasis
  - fluid overload/dehydration
- Parenteral nutrition
  - indications
  - electrolyte needs in first week of life
  - intralipid
- Electrolyte monitoring
  - timing and frequency
- Effects of humidity, maturity, temperature
## VI. Nutrition and Feeding

- GI development and immaturity
- Bone mineralization
- Nutritional requirements
  - calories
  - macro/micronutrients
- Pre-feeding foundations and strategies for positive oral feeds
  - Non-nutritive suckling
  - oral care
- Prevention of growth failure
  - monitoring anthropometric measurements
- Interpretation of lab values to evaluate nutritional status
- Enteral substrates
  - benefits of human milk composition
  - fortifiers
  - supporting lactogenesis
  - education about value of breast milk and lactogenesis
  - breastfeeding
  - donor milk
- Formula composition and indications
- Nutritional supplements

## VII. Respiratory Management/Oxygenation

- Structural and functional immaturity of the ELBW lung
- Ventilation strategies
  - ventilation modes (volume targeted, high frequency non-invasive ventilation)
- Blood gas interpretation and management
  - acid-base homeostasis
- Oxygen delivery and management
  - oxyhemoglobin saturation curve
  - pulse oximetry
  - oxygen saturations
- Prevention of neonatal morbidities
  - BPD (ventilation strategies, surfactant use, caffeine)
  - ROP (FiO<sub>2</sub>)
  - IVH (role of CO<sub>2</sub>)

## VIII. Skin Care

- Structural and functional immaturity
  - epidermal barrier function
  - permeability
  - role in thermoregulation
  - sensory
- Prevention of skin breakdown
  - use of adhesives
  - repositioning
  - medical devices
  - bedding
  - cleansing agents
  - hydrocolloids
  - hydrogels

## IX. Infection Risks

- Immaturity of the ELBW immune system and function
  - environment (lines, tubes)
- Prevention and management of infection
  - catheter-associated infection (best practice bundles)
  - ventilator associated pneumonia
  - oral immune therapy (maternal milk, colostrum)
STUDY GUIDE

DEVELOPMENTAL CARE

I. Neurodevelopment
• Structural and functional immaturity
  stages of brain development at time of delivery
  organization
  myelination
• Brain and neurosensory development

II. Impact of NICU environment
• Neurosensory
• Limbic
  sensory capabilities
  role of smell and taste
  impact of light, noise, sound, vestibular, touch

III. Neuro-protective Intentional Caregiving and
      Promotion of Self-regulation
• Cue-based care
• Handling and positioning
  Containment
• Circadian rhythms
• Kangaroo Care

IV. Neurobehavioral Alterations and Responses
• Habituation
• Motor organization
• State organization
• Sensory/interaction capabilities
• Neurodevelopmental risks and outcomes

V. Stress and Pain Assessment and Management
• Self-regulation
  stability
• Stress response
  autonomic
  motoric
  state/sleep cycle
• Pharmacological and non-pharmacological
  management
• Effects on the developing brain

VI. Neuroprotection and Injury Prevention
• IVH and white matter injury prevention
  strategies/bundles
I. Maternal Risk Factors During Pregnancy that Impact the ELBW Neonate

- Perinatal management
- Maternal transport to high risk perinatal referral center consultation
- Maternal factors
  - Gestational/chronic hypertension
  - HELLP
  - Antenatal corticosteroids
  - Magnesium sulfate
  - Maternal analgesia/anesthesia
  - Maternal medications
  - PROM
  - Diabetes
  - Multiple gestation
- Mode of Delivery
- Obstetric emergencies

II. Cardiac
For specific problems: presentation/assessment, labs, diagnostic imaging, causes, management, complications, outcome

- Patent ductus arteriosus
- Pulmonary hypertension
  - Cor pulmonale
- Hypotension
  - Shock

III. Respiratory
For specific problems: presentation/assessment, labs, diagnostic imaging, causes, management, complications, outcome

- Apnea of prematurity
- Pulmonary hypoplasia
- Respiratory distress syndrome
- Pulmonary air leaks
  - Pneumothorax
  - PIE
- Pulmonary hemorrhage
- Respiratory distress
- Bronchopulmonary dysplasia/chronic lung disease

IV. GI/GU
For specific problems: presentation/assessment, labs, diagnostic imaging, causes, management, complications, outcome

- Perforations/Peritonitis
- Disorders of motility related to immaturity
- Necrotizing enterocolitis
- Disorders of suck and swallow
- GE reflux
- Inguinal hernia
- Short gut syndrome

V. Hematopoietic
For specific problems: presentation/assessment, labs, diagnostic imaging, causes, management, complications, outcome

- Anemia
  - Blood and blood products
- Neutropenia/Neutrophilia
- Thrombocytopenia
- Hyperbilirubinemia
  - Direct and indirect red blood cell turnover
  - Immature impaired conjugation and elimination enterohepatic circulation

VI. Infectious Disease
For specific problems: presentation/assessment, labs, diagnostic imaging, causes, management, complications, outcome

- Sepsis evaluation
- Septic shock
- Viral and fungal infections
  - Candidiasis
- Late onset sepsis
  - Hospital acquired infection
  - UTI
  - Osteomyelitis
  - Meningitis
  - MRSA
VII. Metabolic/Endocrine/Genetics
For specific problems: presentation/assessment, labs, diagnostic imaging, causes, management, complications, outcome

• Thyroid disorders
• Adrenal insufficiency
• Glucose homeostasis
• Metabolic bone disease
  osteopenia
  rickets
  fractures
• Metabolic screen interpretation

VIII. Neurologic, Neuromuscular, skin and Musculoskeletal
For specific problems: presentation/assessment, labs, causes, management, complications, outcome

• Skin injuries
  burns
  pressure injuries
  tears
• Periventricular/Intraventricular hemorrhage
• Post-hemorrhagic hydrocephalus
• Periventricular leukomalacia
• Seizures
• Hemangiomas
• Dislocation of the hip

IX. Renal
For specific problems: presentation/assessment, labs, causes, management, complications, outcome

• Acute renal failure
  SIADH
• High output real failure
• Renal vein/artery thrombosis
• Renal insufficiency
  Hypertension

X. Head, Eyes, Ears, Nose and Throat
For specific problems: presentation/assessment, labs, diagnostic imaging causes, management, complications, outcome

• Retinopathy of prematurity
  target O₂ saturations
• Airway malacia/stenosis
• Vocal cord paralysis
• Hearing loss

XI. Pharmacology
• Pharmacokinetics and pharmacotherapeutics
  drug use and precautions
  distribution
  absorption
  metabolism
  excretion
  drug levels
  drug effects
• Common drugs
  antibiotics/antifungals
  anesthesia/analgesia concurrent use with non-pharmacological management
  bronchodilators
  cardiovascular agents
  inotropes and vasopressors
  PDA treatments
  caffeine
  diuretics
  steroids
  surfactant
  ROP treatment
• Antibiotic Stewardship
  risk with exposure and developing intestinal mucosa
  risk for repeated courses secondary to multiple sepsis evaluations
I. Family Integration
- Prenatal consultation
- Family partnered care
- Parental role attainment
  Barriers
  Bonding
- Special circumstances
  Adolescent parents
  Extended family
- Parent teaching
- Shared decision making
  Parent/staff disagreements
- Breastfeeding support
- Family support and education

II. Discharge Planning, Teaching and Follow Up
- General discharge planning
- Newborn screening
  Car seats
  Metabolic
  Hearing
  CCHD screening
  ROP exam
- Parent education/training
  Feeding/nutrition
  Safe sleep
  Immunizations
  Importance of follow up
  Special equipment
  Parent readiness
- Follow up
  Clinics
  Nursing care
  Community resources
  Equipment
  Early interventions/development follow up

III. Trauma Informed Care/Parental Coping and Grieving Process
- Stages of grief and common behaviors
  and interventions
- Specific circumstances
  Chronic sorrow
  Death of twin
  Repeated obstetric loss or preterm deliveries
  Sibling responses

- Parent mental health
  Post-traumatic stress disorder
  Post-partum depression
  Incongruent grieving
- Support systems
- Parental stress responses

IV. End of Life Care/Palliative Care/Viability and Legal/Ethic Issues
- Non-initiation
- Withdrawal
- Comfort care
- Parental desire for futile care
- Outcomes
- Cultural sensitivity
- Ethical principles
  Autonomy
  Beneficence
  Non-maleficence
  Justice

V. Professional Practice
- Communication tools
- Inter-professional teamwork
- Continuity/Continuum of care
- Compassion fatigue

VI. EBP, QI, Research, Data Outcomes, Benchmarking
- Small baby risks
  Data outcomes
- Benchmarking
- QI
- Process improvement

VII. Communication of outcomes
- Motor
- Cognitive
- Language delays
- Expected milestones
Verklan, et al., Core Curriculum for Neonatal Intensive Care Nursing, Elsevier, 2021