WORKING TOGETHER FOR BEST OUTCOMES:

Interdisciplinary Evidence-Based Practice Strategies in ELBW Care

SUMMARY

engage grow thrive
An interdisciplinary healthcare approach to improving lives

Introduction

Premature birth remains a global health issue. The extremely low birth weight (ELBW) or 'small baby,' weighing less than 1000 grams at birth, is at high risk for prolonged hospitalization, long-term morbidities including neurodevelopmental challenges, family stress, and infant death.[1] More small babies survive until discharge from the NICU, with survival rates for the earliest gestations increasing.[2] However, survival may include complications that last a lifetime.

The care of a small baby is complex. This paper aims to share key concepts of small baby care, not to provide a comprehensive review. We intend to highlight why the small baby is at risk, key evidence-based practice (EBP), and the imperative to implement EBP using the interdisciplinary neonatal team's shared mental model of care.

To download the comprehensive white paper with reference list, click or scan here:

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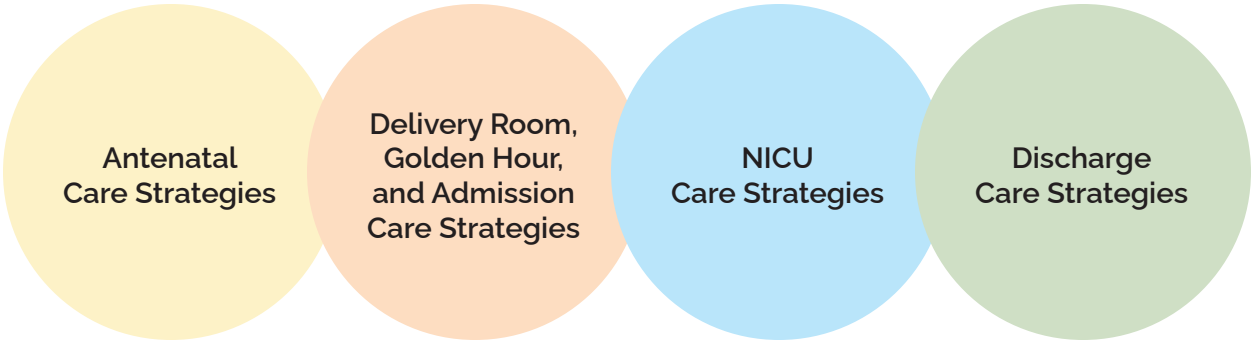
Interdisciplinary team engagement is an essential component of quality improvement (QI). An engaged, unified team helps solidify a shared mental model of evidence-based care, improving consistency in practice.

Evidence-based ELBW care strategies will be outlined in this summary using the following categories:



Thermoregulation

Thermoregulation is foundational to all neonatal care.[1] One study looked at over 4,000 infants < 26 weeks gestation and showed that hypothermia was independently associated with death.[2] This emphasizes the importance of thoroughly understanding temperature control, its effects, and best practices to help support normothermia in the small baby.[2-5] Utilizing evidence to design delivery room bundles, humidity protocols, daily care, and weaning guidelines can help support normothermia.

Thermoregulation [2,4,13,16,27-29,32-34]

- Utilize golden hour thermoregulation bundles - thermal hats, polyethylene wraps, thermal mattress (remove when patient reaches normothermia (36.5 - 37.5˚C)
- Warm delivery room to 25-26˚C ambient temperature
- Prewarm radiant warmer and intravenous (IV) fluids and tubing
- Use a warmed sterile blanket beneath and around the infant during delayed cord clamping
- Provide heated humidified gases
- ***Family Engagement:*** Encourage and facilitate skin-to-skin holding, hand hugs

- NICU Thermostats 72˚F to 78˚F (22–26˚C) and relative ambient humidity of 30-60%
- Utilize incubator humidity protocols for initial weeks of care
- Use skin and axillary temperatures for vital sign assessment
- Care in incubator
  - Utilize incubator coverings, which decrease radiant heat loss
  - Minimize unnecessary entry into the incubator
  - Utilize heat shields or other heating devices of incubators prior to entering
  - Provide care through portholes to minimize humidity and heat loss
- Use heated humidified gases and warm breast milk and formulas
- When performing direct care unwrap the baby in phases; keep the lower portion of body covered while assessing heart tones and lung sounds, then support the upper body with warmth while remaining care is provided (minimizes heat loss and swings in temperature)
- Use developmental supports for keeping infants warm
- Wean incubators to 25-26˚C prior to weaning from incubator to optimize successful wean
- ***Family Engagement:*** Skin-to-skin holding, hand hugs

- Provide Parent education on home temperature environment and infant dress

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Nutrition

The birth of a preterm infant has been called a nutritional emergency.[1] At birth, all newborns lose the delivery of nutrition via the placenta. Birth before the last trimester of gestation leaves the small baby without adequate nutrient stores of glucose, protein, fat, and electrolytes to provide energy for growth and development, placing them at immediate risk of catabolism.[2]

Nutrition [2,6-8,11,12,20-26]
• Collaborate with obstetric team on importance of breast milk • Educate family on the importance of breast milk • Early lactation consult • Establish a plan for early and ongoing milk expression

• Initiate starter TPN within first hour of life
  ◦ Dextrose to supply a minimum glucose infusion rate (GIR) of 4-6 mg/kg/min
  ◦ Protein 2.5-3 gm/kg/day
• Provide colostrum oral immune therapy as soon as it is available and ongoing at least Q 6 hours (this should ideally be part of the admission order set)
• ***Family Engagement***:
  ◦ Encourage early hand expression or pumping for colostrum and administer as soon as available
  ◦ Encourage and facilitate skin-to-skin holding, hand hugs, nurturing touch

• Optimize TPN macronutrients: glucose, protein, fat (initiate in 1st 24 hours)
  ◦ Judicious fluid while optimizing nutritional delivery
  ◦ Meticulous electrolyte management
• Initiate enteral feeds with human milk (preferably Mother's Own Milk [MOM]) via a standardized feeding protocol within 24 hours of life for most small babies. Progress toward nutrient goals with transition from PN to EN
• Perform interdisciplinary rounds at least weekly to discuss nutrition, growth, and adjust plan as needed
• Provide ongoing lactation support, including long-term pumping support and encouragement
• Facilitate establishment of oral feeding
  ◦ Provide positive oral stimulation early, often, and throughout the hospital stay
  ◦ Facilitate early non-nutritive breast contact, transitioning to breastfeeding
• ***Family Engagement:***
  ◦ Educate to the importance of growth
  ◦ Promote active participation in nutrition rounds and growth monitoring
  ◦ Provide non-nutritive suckling time at the breast
  ◦ Encourage and facilitate skin-to-skin holding

• Educate and affirm a home feeding plan (any supplements, breastfeeding)   ◦ Ensure communication/coordination with pediatrician

Respiratory Care

There are three general small baby physiologic factors that influence respiratory function: immature underdeveloped lungs, surfactant deficiency, and immaturity of the central nervous system respiratory drive. These place the small baby at risk of developing respiratory distress syndrome (RDS), bronchopulmonary dysplasia (BPD) or chronic lung disease (CLD), and apnea of prematurity (AOP).

Respiratory Care [2,4-7,12,20,25]

RDS

- Ensure antenatal steroid administration as indicated, which accelerates fetal lung development
- Take measures to prevent chorioamnionitis
- Provide a prenatal meeting with family, including discussion of respiratory risks

- Delay umbilical cord clamping
- Ensure resuscitation team understands the prevention of pulmonary complications begins at birth; utilize a lung protective strategy
  - Use of a T-piece resuscitator delivers controlled, specified positive pressure protecting from barotrauma
- Communicate a team shared mental model for maintaining FRC and non-invasive ventilation strategy when able
- Use blended oxygen administration for desired oxygen concentration
- Provide early surfactant administration for infants with signs of RDS
- ***Family Engagement:*** Encourage and facilitate touch and contact

- Support oxygenation and treat hypoxemia
  - Oxygen administration stewardship and saturation targeting
- Use an evidence-based ventilation management strategy
  - Treat respiratory acidosis
  - Establish and maintain FRC
    - Two-person/Four-handed caregiving
  - Avoid lung injury (barotrauma and volutrauma)
    - Volume-targeted, pressure-limited strategies
  - Utilize non-invasive ventilation as able
- Use an evidence-based surfactant administration [RDS] strategy
  - Selective intubation and surfactant
    - INSURE [Intubation, Surfactant, Extubation]
  - Minimally invasive administration [laryngoscopy with catheter administration]
    - LISA [Less Invasive Surfactant Administration]
    - MIST [Minimally Invasive Surfactant Therapy]
  - Extubate to non-invasive as soon as possible
- Initiate caffeine therapy early
- Suction only as needed
- Avoid co-morbidities: Prevent infection, optimize nutrition for lung growth (MOM)
- ***Family Engagement:***
  - Educate about pulmonary development
  - Provide mother's milk, early colostrum
  - Facilitate skin-to-skin holding as much as possible
  - Facilitate nurturing touch and participation in hands-on care times

Apnea

- Utilize CPAP, NIPPV to maintain FRC
- Provide early caffeine
- ***Family Engagement:*** Encourage and facilitate touch and contact

Cardiac Care: PDA

The ductus arteriosus (DA) is a fetal vascular structure routing circulation away from the fetal lungs to optimize systemic oxygenation.[1] Although the DA closes in the first few days of life in most newborns, because of structural and functional immaturity of the preterm infant, the DA is slower or resistant to closure.[1] Small babies born at the earliest gestational ages are particularly challenged with spontaneous DA closure called a patent ductus arteriosus (PDA).

Cardiac Care: PDA[2,6,21-23]

- Delay cord clamping to improve hemodynamic stability and oxygenation
- Establish adequate oxygenation and ventilation
- ***Family Engagement:*** Facilitate touch and contact

- Avoid fluid overload to reduce pulmonary edema and L –> R shunt
- Maintain PEEP/FRC – prevent atelectasis
- Support oxygenation and ventilation (improved oxygenation constricts DA)
- Evaluate clinical status of each infant with PDA
  - Consider allowing time for spontaneous closure in stable infants
  - If providing pharmacologic therapy:
    - Evaluate fluid management
    - Continue to optimize nutrition
    - Evaluate if receiving other nephrotoxic medications
  - If providing surgical ligation:
    - Anticipate post-surgery recovery needs from thoracotomy with lung retraction (atelectasis), general anesthesia, possible hemodynamic instability (post-ligation syndrome)
    - Prepare family for possible post-surgery cardiopulmonary worsening status (higher oxygen and ventilator needs) prior to recovery and improvement
  - Prevent hypothermia during procedures outside NICU
  - Optimize team communication (neonatal and cardiology)
- Avoid co-morbidities
  - Optimize nutrition for growth; provide MOM
  - Prevent infection
  - Mindful respiratory practices – higher risk of BPD with PDA and treated PDA
- ***Family Engagement:***
  - Educate in appropriate terms about anatomy & physiology of PDA
    - Discuss options and risks; promote participation in decision making
  - Provide mother's milk, early colostrum
  - Facilitate skin-to-skin holding, nurturing touch and participation in hands-on care times as much as possible

- Evaluate for pulmonary hypertension prior to discharge, especially with diagnosis of BPD
- If discharged home with PDA: schedule cardiology follow-up, close monitoring of growth

Protecting Neurodevelopment

The majority of neurodevelopment occurs between the second and third trimesters. Premature delivery causes disruption, damage, and deprivation in the infant's physical, social and emotional environment.[1] This can alter the preterm infant's underdeveloped neuro-physiological response, placing the baby at risk of both short-term injurious complications and long-term neurodevelopmental and neurocognitive sequelae.[2]

Protecting Neurodevelopment [3,6,34,60-64]

- Ensure prenatal care to reduce the risk of preterm birth
- Provide antenatal counseling/education
- Administer corticosteroids & $MgSO_4$ if indicated

IVH/WMI/Sensory System Protection	Neuromuscular

• Facilitate team briefing
• Delay cord clamping
• Provide a neuroprotective environment; use slow and purposeful handling
• Prevent hypothermia
• Utilize non-invasive ventilation when able
  ° Avoid hyperinflation and utilize oxygen targeting
• Use neuroprotective care bundles
  ° Avoid rapid infusion of fluids
  ° Avoid elevations in cerebral blood flow
  ° Consider increase HOB to 15-30 degrees
• Provide early Starter TPN
• Utilize non-pharmacological comfort measures during procedures
• ***Family Engagement:*** Facilitate early hand hugs
	• Use nesting device to promote a midline, flexed fetal posture

• Provide tolerance-based care in a neuroprotective environment
• Utilize evidence-based strategies to prevent comorbidities (e.g., infection, NEC)
• Utilize evidence-based respiratory support strategies
  ° Non-invasive ventilation/avoid hyperinflation
  » Initiate caffeine therapy early
  » Suction only as needed
• Provide continuity/consistency in care
• Decrease pain and stress
• Utilize Non-pharmacological pain management strategies
• Facilitate Non-Nutritive Sucking (NNS)
• Provide 2-person hands-on care
• Maintain legs below the level of the head during diaper changes
• Maintain decibel levels < 50; Silence alarms quickly and use quiet voices
  ° Encourage parental voice
• Facilitate interdisciplinary collaboration on sensory input
• ***Family Engagement:***
  ° Facilitate early nurturing touch and skin-to-skin contact
  ° Provide early colostrum & maternal breastmilk
  ° Provide exposure to parental voice
  ° Provide infant massage as tolerated, when clinically able
  ° Provide swaddled bathing when clinically able
  ° Encourage parental bedside presence and participation in all care
	• Support proper posture and movement
	• Optimize skeletal development and biomechanical alignment with firm boundaries
	• Provide controlled exposure to varied proprioceptive, tactile, and visual stimuli
	• Support physiologic stability
	• Use facilitated tucking for painful procedures
	• Utilize developmental supports to facilitate boundaries and proprioceptive input

• Educate on importance of neurodevelopmental follow-up • Continue to encourage skin-to-skin contact • Teach and encourage swaddled bathing	• Transition to safe sleep • Role-model tummy time

Infection

Infection, which can present any time during the hospital course, is a contributing factor to the morbidity and mortality of all infants; however, the incidence is 20% higher in the premature infant and increases further in the ELBW baby.[1] The incidence of sepsis in infants born weighing less than 1500 grams is 11-22.7 per 1000 live births, compared to just 0.3-0.98 per 1000 live births of infants born after 37 completed weeks of gestation.[1] Immune systems do not function at optimal levels in the perinatal period, increasing the preterm infant's chance of developing both early- and late-onset sepsis.

<table>
<tr><th colspan="2">Infection [1-3, 5 ,9, 12, 14, 16, 18]</th></tr>
<tr><td colspan="2">• Promote prenatal care, assess and manage risk factors for preterm labor and premature rupture of membranes (PROM)
• Conduct maternal screening and provide treatment with intrapartum antibiotics as indicated</td></tr>
<tr><th>Early-Onset Sepsis</th><th>Late-Onset Sepsis</th></tr>
<tr><td>• Use polyethylene wrap to maintain infant skin integrity
• Facilitate parental touch</td><td>• Ensure proper handwashing and proper use of personal protective equipment (PPE) for all care and IV access
• Protect integrity of skin during admission process</td></tr>
<tr><td>• Ensure proper handwashing & proper use of personal protective equipment (PPE) for all care and IV access

• Family Engagement: Facilitate parental touch</td><td>• Implement antibiotic stewardship programs
° Choose narrower-spectrum antibiotics by cultures and microbiology in lieu of empiric broad-spectrum
• Utilize skin care guidelines that include early humidification, minimal use of adhesives/chemicals and cleansing practices that maintain biological functions
• Ensure proper handwashing and proper use of PPE for all care & IV access and invasive procedures
• Use CLABSI Prevention Bundles with standardized approach to invasive line placement & removal (Solutions for Patient Safety)
° Conduct ongoing hand hygiene monitoring
• Family Engagement:
° Provide early colostrum oral immune therapy & early MOM
° Facilitate early skin-to-skin for microbiome benefits of maternal skin flora
° Encourage participation in NICU antibiotic stewardship rounds</td></tr>
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Discharge Planning

Preterm infants complete their gestational development during their NICU stay. Because of this interruption in the normal sequence of development, they are at increased risk for all complications, requiring more extensive discharge follow up. The complex preterm infant may be discharged home on medications, outpatient therapy, and subspecialty follow-up appointments requiring coordination of care for the family.

Discharge Planning [1-16]	
Foundational Information: Essential for every family	• NICU team sets clear, understandable discharge criteria and messaging for what family & infant need to accomplish as discharge is conditional on clinical indications and infant readiness. (e.g., no further A/B spells, able to gain weight, etc.) • Parents have knowledge regarding discharge screenings, testing, immunizations and the need for ongoing follow up care • Discharge tools could include: discharge summary, written materials, road map, journals
Anticipatory Guidance: Provides a realistic idea of what life will be like once home, including the first days, weeks, months and beyond	• Parent involvement with education is essential: ° Return demonstration for medications or clinical condition-specific care ° Involved in making discharge appointments and/or creating schedules for daily life events (e.g., feeding times, medication administration times, appointments, etc.). • Neurodevelopment education and support should focus on the following: ° Comfort and security through consistent presence ° Identifying and responding to infant behavioral cues » Parents trained in recognizing stress cues and providing protective care have more sensitivity to their infants and respond appropriately to their cues ° Providing a supportive environment with positive and nurturing experiences such as swaddled bathing ° Recognizing the importance of sleep for growth and brain development ° Education on continued developmental positioning, supportive touch, positioning and handling and continued STS care • Develop NICU guidelines that support a safe transition from developmental supports to safe sleep environment ° Educate parents on safe sleep practices emphasizing the importance of tummy time to strengthen neck, arms, and trunk for future milestones of rolling, sitting and crawling ° Encourage parents to continue shaping their infant's musculoskeletal system during the first year of life when maximum plasticity occurs. » Change direction of infant's head in crib to prevent plagiocephaly & encourage parents to report signs of head flattening, strong head turn preference, or asymmetrical arm use » Place wings, head and trunk rolls in car seats to maintain head midline • Explain the adjustment period: new environment; they may see changes in their infant's patterns from the NICU to home, as well as changes in parental mental health • Collaboratively identify and document who to call and where to go in emergencies • Have parents verbalize the importance of follow-up care and incorporate recommendations into daily life (early intervention programs, ROP follow-up, PT/OT referrals, specialty physicians, etc.)
Family & Home Assessment: Identifies needs for specific community resources	There should be a process for connecting families with community resources that meet their specific assessed needs. These resources should address risk factors through early referral to community partners for needed medical, physical, psychosocial, and mental health needs of both the family and infant (Housing, finances). It is preferred to use a multidisciplinary team (that includes nursing, social work, case management) inclusive of the family to assess their needs
Coordination of care across the continuum: Helps facilitate smooth transfer & continuation of specific needs	The NICU team should have processes or roles (e.g. Discharge Coordinator) to communicate each patient's NICU course to community providers. It's important that there be closed loop communication surrounding transfer of care and also connecting families to a community-based, peer-to-peer support program.
Other Considerations: Tailors interventions to cultural and philosophical needs	NICU teams need to be mindful of the various needs of all families, including: those with limited English proficiency, active military, lesbian, gay, bisexual, transgender, intersex, and asexual (LGBTQIA+), disabled, and/or culturally and/or philosophically distinct in order to best meet each family's important and unique needs during the transition to home.