Association of Women's Health, Obstetric and Neonatal Nurses

ASSESSMENT AND CARE OF THE LATE PRETERM INFANT EVIDENCE-BASED CLINICAL PRACTICE GUIDELINE

Third Edition

About AWHONN

Headquartered in Washington, DC, the Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) is a leader among the nation's nursing associations, serving more than 25,000 nurses in the United States, Canada, and abroad and representing more than 350,000 nurses in our specialty.

AWHONN advances the nursing profession by providing nurses with critical information and support to help them deliver the highest quality care for women and newborns. Through its many evidence-based education and practice resources, legislative programs, research, and coalition work with other organizations and associations, AWHONN has firmly established itself as the leading association for women's health, obstetric, and neonatal nurses.

AWHONN members strive to deliver superior health care to women and newborns in hospital, home health, and ambulatory care settings. The rich diversity of members' skills and experience make AWHONN *the* voice for women's health and neonatal nursing. It is through their dedication, knowledge, skill, and expertise that we create resources aimed at achieving our mission to promote the health of women and newborns.

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This Evidence-Based Clinical Practice Guideline was developed for AWHONN as an informational resource for nursing practice. The Guideline does not define a standard of care, nor is it intended to dictate an exclusive course of management. It presents general methods and techniques of practice that AWHONN believes to be currently and widely viewed as acceptable, based on current research and recognized authorities.

Proper care of individual patients may depend on many individual factors to be considered in clinical practice, as well as professional judgment in the techniques described herein. Variations and innovations that are consistent with law and that demonstrably improve the quality of patient care should be encouraged. AWHONN believes the drug classifications and product selection set forth in this text are in accordance with current recommendations and practice at the time of publication. However, in view of ongoing research, changes in government regulations, and the constant flow of information relating to drug therapy and drug reactions, the reader is urged to check information available in other published sources for each drug for potential changes in indications, dosages, warnings, and precautions. This is particularly important when a recommended agent is a new product or drug or an infrequently employed drug. In addition, appropriate medication use may depend on unique factors such as individuals' health status, other medication use, and other factors that the professional must consider in clinical practice.

The information presented here is not designed to define standards of practice for employment, licensure, discipline, legal, or other purposes.

ACKNOWLEDGMENTS

Assessment and Care of the Late Preterm Infant Evidence-Based Clinical Practice Guideline, Third Edition, was developed by the Evidence-Based Clinical Practice Guideline Science Team, which is made up of AWHONN member experts who are recognized for their significant contributions to clinical practice and research in the care of newborns and their families. The team members were selected for their expertise as clinicians, educators, and scientists dedicated to improving the health and well-being of women and newborns in obstetric, postpartum, and neonatal settings.

AWHONN gratefully acknowledges the work of the individuals who have contributed their time and expertise to promoting evidence-based practice in nursing and who have been instrumental in disseminating a growing body of knowledge on providing safe care to late preterm newborns and their parents.

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Assessment and Care of the Late Preterm Infant

PURPOSE STATEMENT

The purpose of this Guideline is to enhance knowledge of the risks of late preterm birth and the unique needs of the late preterm infant (LPI) to facilitate timely assessment and intervention that is derived from scientific evidence. The Guideline describes evidence-based approaches to accomplish the following:

- Recognize the physiologic limitations and challenges of an LPI that place the LPI at increased risk for complications.
- Validate the LPI's gestational age.
- Assess the risk for and implement appropriate interventions to help prevent and manage the following complications: respiratory distress, hypothermia, hypoglycemia, sepsis, hyperbilirubinemia, and feeding issues.
- Promote strategies that incorporate discharge planning and parent education from birth through discharge.

TARGET POPULATION

The Guideline is directed toward the care of newborns born between 34 weeks and 0 days and 36 weeks and 6 days of gestation, their parents, and any identified primary support person(s). For the purposes of this Guideline, *LPI* is the term used consistently to refer to this population of newborns.

SETTINGS

The Guideline is applicable in all health care settings in which LPIs may receive care, such as labor and birthing units, postpartum units, low-risk neonatal care units, neonatal intensive care units (NICUs), and in the community after discharge. Portions of this Guideline may also be applicable to settings where pregnant people receive care.

PROVIDERS

The Guideline is directed toward registered nurses, advanced practice registered nurses, and other health care professionals responsible for managing or providing care to newborns and pregnant people. Selected elements of the Guideline may be appropriate for use by parents or other caregivers after a newborn is discharged to home.

EVIDENCE-BASED GUIDELINE DEVELOPMENT PROCESS

Nursing specialty organizations are in a unique position to facilitate the use of research findings in clinical practice through the guideline development process. AWHONN, as a leader in women's health, obstetric, and neonatal nursing, elected to participate in the international movement to develop guidelines for evidence-based decision-making in accordance with its mission to improve the health of women and newborns. The original AWHONN template for guideline development is based on the framework delineated in the American Nurses Association's (ANA's) *Manual to Develop Guidelines* (Marek & ANA Committee on Nursing Practice Standards and Guidelines, 1995). The ANA *Manual* models its process on that of the Agency for Healthcare Research and Quality, formerly the Agency for Health Care Policy and Research (Woolf, 1990). As the Guideline development process has evolved, AWHONN's science teams have incorporated the components of the Appraisal of Guidelines for Research and Evaluation (AGREE) II tool into the development process (Brouwers et al., 2010).

SCIENCE TEAM MEMBER SELECTION

Development of this Guideline included a national call to convene a team of AWHONN expert members to serve as the Evidence-Based Clinical Practice Guideline Science Team (Science Team). After a review of curricula vitae, summary statements of expertise, and phone interviews, a team of eight members was selected. This team included members with various levels of education practicing in geographically diverse obstetric, neonatal, academic, and research settings. Team member roles included clinical nurses, clinical nurse educators, advanced practice nurses, nurse managers, and nurse scientists. In addition, two AWHONN nurse leaders worked as Science Team members and in advisory roles during the Guideline development process. The Science Team members self-selected to work on the literature review, writing team, review team, and/or parent education team.

EVOLUTION OF THE GUIDELINE

Team members participated in monthly or bimonthly videoconferences to identify the purpose, population, settings, and providers. The initial meetings included exploring the second edition of this evidence-based guideline and identifying gaps in care needs. In addition, the team identified search terms that were likely to generate a comprehensive literature review. Several topic-specific electronic database searches and manual searches were conducted by the AWHONN librarian to identify relevant literature. Specifically, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, Scopus, and the Cochrane Library were searched for journal articles published in English within the past 7 years and focused primarily on developed countries. The Science Team included literature focused on countries that had neonatal care practices similar to those in the United States. In addition, relevant guidelines from professional organizations were examined carefully to gather information about current recommendations focused on late preterm care. From this information, the team identified applicable search terms.

Search Terms

The primary search terms for the Evidence-Based Guideline were *late preterm infant* or *LPI* or both, combined with the following:

- general *or* outcomes
- gestational age assessment
- respiratory distress
  - SUPC *or* sudden unexplained postnatal collapse
  - RSV *or* respiratory syncytial virus
- thermoregulation *or* hypothermia
  - skin-to-skin contact *or* kangaroo care
  - SUPC *or* sudden unexplained infant death
- hypoglycemia
- sepsis
- jaundice or hyperbilirubinemia
- feeding challenges
  - breastfeeding
  - infant driven feeding
  - supplementation
  - triple feeding
  - hand expression
  - donor human milk
  - magnesium sulfate
- parent education
  - SIDS *or* sudden infant death syndrome
- discharge
- follow-up *or* home visit
- neurodevelopment

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Article Selection, Scoring, and Guideline Development

The team used Covidence, an online tool (Veritas Health Innovation, n.d.), to help screen references and complete data extraction in a systematic way. The combined search terms yielded 1,644 abstracts, and 405 duplicate abstracts were removed. In sections divided by search terms, 1,239 abstracts were reviewed and considered by at least two Science Team members. The team determined the inclusion and exclusion criteria for abstract selection (see Table EBG-1). Consensus on the rating of evidence was obtained by at least two Science Team members before an article could be included as supporting rationale for the clinical practice recommendations in the Guideline.

TABLE EBG-1 INCLUSION AND EXCLUSION CRITERIA

Inclusion	Exclusion

• LPIs:
  ◦ 34 0/7–36 6/7 weeks
  ◦ First 28 days of life
• Humans
• English only
• Literature from developed countries
	• Newborns < 34 weeks or ≥ 37 weeks of gestation
	• LPIs older than 28 days of life
	• LPIs with serious congenital anomalies or illness
	• Individual case reports
	• Birthweight < 1,500 g

Literature was scored by team consensus using the levels-of-evidence pyramid created by the Helene Fuld Health Trust National Institute for Evidence-based Practice at The Ohio State University College of Nursing (Melnyk & Fineoult-Overholt, 2015; see Appendix EBG-A), with separate scoring of qualitative research using the qualitative hierarchy of evidence for practice proposed by Daly et al. (2006; see Appendix EBG-B). A total of 871 articles were read and scored, and 212 were moved through a data extraction process for consideration in the Guideline development.

Draft sections of key topics of focus, including pertinent clinical practice recommendations accompanied by referenced rationale statements, were created by two Science Team members. Individual and group videoconference meetings were held to further review, refine, and obtain consensus for all clinical practice recommendations and supportive rationale statements with the AWHONN nurse leader and the co-leaders of the Science Team. In addition, all Science Team members participated in the review process.

Guideline Review

The draft Guideline was sent to the review team for an extensive review and critique. The Science Team leader and the AWHONN nurse leaders reviewed the comments obtained during the review, applying the AGREE II tools, and reached a consensus on incorporating the comments into the final document.

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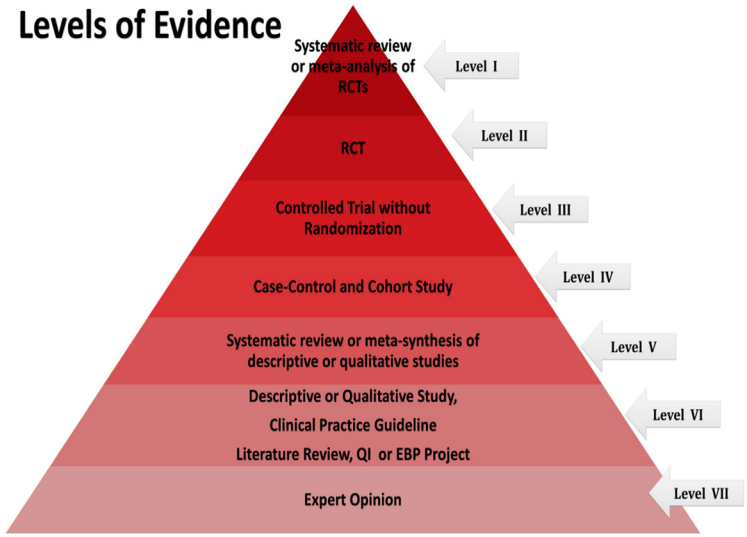
APPENDIX EBG-A. QUANTITATIVE SCORING TOOL



Note. EBP = evidence-based practice; QI = quality improvement; RCT = randomized controlled trial. Used with permission from the Fuld National Institute for Evidence-based Practice in Nursing and Healthcare.

APPENDIX EBG-B. QUALITATIVE SCORING TOOL

A hierarchy of evidence-for-practice in qualitative research—summary features

Study type	Features	Limitations	Evidence for practice
Generalizable studies (level I)	Sampling focused by theory and the literature, extended as a result of analysis to capture diversity of experience. Analytic procedures comprehensive and clear. Located in the literature to assess relevance to other settings.	Main limitations are in reporting when the word length of articles does not allow a comprehensive account of complex procedures.	Clear indications for practice or policy may offer support for current practice, or critique with indicated directions for change.
Conceptual studies (level II)	Theoretical concepts guide sample selection, based on analysis of literature. May be limited to one group about which little is known or a number of important subgroups. Conceptual analysis recognizes diversity in participants' views.	Theoretical concepts and minority or divergent views that emerge during analysis do not lead to further sampling. Categories for analysis may not be saturated.	Weaker designs identify the need for further research on other groups, or urge caution in practice. Well-developed studies can provide good evidence if residual uncertainties are clearly identified.
Descriptive studies (level III)	Sample selected to illustrate practical rather than theoretical issues. Record a range of illustrative quotes including themes from the accounts of "many," "most," or "some" study participants.	Do not report full range of responses. Sample not diversified to analyze how or why differences occur.	Demonstrate that a phenomenon exists in a defined group. Identify practice issues for further consideration.
Single case study (level IV)	Provides rich data on the views or experiences of one person. Can provide insights in unexplored contexts.	Does not analyze applicability to other contexts.	Alerts practitioners to the existence of an unusual phenomenon.

Note. From "A Hierarchy of Evidence for Assessing Qualitative Health Research," by J. Daly, K. Willis, R. Small, J. Green, N. Welch, M. Kealy, & E. Hughes, 2006, *Journal of Clinical Epidemiology*, *60*(1), p. 43–49 (https://doi.org/10.1016/j.jclinepi.2006.03.014).

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Preface

THE AWHONN LATE PRETERM INFANT INITIATIVE

In 2005, AWHONN launched the multiyear Late Preterm Infant Initiative in recognition of the importance of late preterm birth as a significant clinical issue that necessitated the development of new resources aimed at addressing the special needs of this population. Its goals included increasing health care provider and consumer awareness of the risks associated with late preterm birth and ensuring that evidence-based educational resources and guidelines were available to assist nurses and other health care providers in providing appropriate assessment and care for these vulnerable newborns.

AWHONN'S CONCEPTUAL MODEL FOR LATE PRETERM INFANT CARE

The *Assessment and Care of the Late Preterm Infant Evidence-Based Clinical Practice Guideline, Third Edition*, provides registered nurses, advanced practice registered nurses, and other health care providers with detailed information about the risks associated with late preterm birth and recommendations for providing comprehensive care and parent education. The approach to assessment and care planning for LPIs should be guided by recognition of the value and importance of the key components of AWHONN's Conceptual Model for Optimizing Late Preterm Term Infant Outcomes (Medoff-Cooper et al., 2005). The model was developed to provide the framework for the Late Preterm Infant Initiative and integrates the concepts of neonatal physiologic functional status, nursing care practices, care environment, and the essential role of the family, both in the hospital and following discharge. Each of these concepts is interrelated and integral to promoting and ensuring optimal health outcomes for the LPI, which is represented as the core of the conceptual model (see Figure LPI-1).

The following operational definitions and their descriptions serve to guide the development of programs and resources within AWHONN's initiative and are provided to facilitate comprehensive and family-focused assessment and care of these newborns (Medoff-Cooper et al., 2005):

- **Physiologic functional status:** The state of a neonate's physiologic and functional well-being, influenced by factors such as postmenstrual age, transition to extrauterine life, maternal–fetal health and history, timing and method of birth, and location and quality of care.
- **Nursing care practices:** The nature and quality of LPI care provided by registered and advanced practice nurses. Although AWHONN educational resources are directed primarily toward registered and advanced practice nurses, the approach to assessment and care of late preterm newborns should be multidisciplinary, including care providers such as neonatal and pediatric physicians, developmental specialists, lactation consultants, and social services professionals.
- **Care environment:** The location of care and the social, cultural, political, and economic context in which care is provided to LPIs.
- **Family role:** The character, extent, and quality of family involvement in the care of the LPI.
- **Healthy outcomes for the LPI:** A medically stable infant discharged at an optimal time that minimizes the risk for rehospitalization.

FIGURE LPI-1 AWHONN'S CONCEPTUAL MODEL FOR OPTIMIZING LATE PRETERM INFANT OUTCOMES

SIGNIFICANCE OF LATE PRETERM BIRTH

Prematurity is one of the most significant threats to the health and well-being of newborns and their families. It is the second leading cause of infant mortality in the United States (Centers for Disease Control and Prevention [CDC], 2022). Late preterm birth (defined as birth between 34 weeks and 0 days and 36 weeks and 6 days of gestation) accounts for most of the increase in preterm births seen in the past 20 years in the United States (Martin & Osterman, 2022). Mortality rates for LPIs are three times higher than those for term infants (born at 37–41 weeks of gestation; Morgan & Boyle, 2018). According to the National Center for Health Statistics, the rate of late preterm birth was 7.4% in 2020 (Osterman et al., 2022).

Although it is encouraging that the overall rate of preterm birth has declined slightly, from 10.23% in 2019 to 10.09% in 2020 (Osterman et al., 2022), late preterm births continue to make up more than 70% of all preterm births in the United States (Karnati et al., 2020; Osterman et al., 2022).

Late preterm births represent a unique challenge for health care professionals in community hospitals and tertiary care settings. With birth weights typically ranging from 4.6 to 6.7 lb, some LPIs may appear physically well developed when compared with their more premature counterparts (Lorenzo et al., 2021). Because of their size, their initial stability in the birthing room, and the mature physical appearance of some of these infants, they are often cared for in the normal newborn nursery. Consequently, it may be easy to overlook the fact that most LPIs lack the neurologic and physiologic maturation of their full-term counterparts (Jois, 2018; Karnati et al., 2020; Lorenzo et al., 2021). LPIs are more likely than term newborns to be readmitted to the hospital for complications. The most common reasons for readmission consistently remain hyperbilirubinemia, feeding complications (e.g., failure to thrive, dehydration, electrolyte imbalances), or to rule out sepsis (Karnati et al., 2020; Morgan & Boyle, 2018). Among LPIs, the risk for rehospitalization is highest in those who were never admitted to the NICU, had short NICU stays, or were discharged from the hospital after less than 4 days (Karnati et al., 2020).

Heightened attention paid to this population of newborns in recent years has identified respiratory distress, thermal instability, hypoglycemia, hyperbilirubinemia, sepsis, and feeding challenges as the most diagnosed complications associated with late preterm birth (Lorenzo et al., 2021; Mengistu et al., 2021; Morgan & Boyle, 2018). LPIs born small for gestational age (SGA) are more likely to be admitted to the NICU, need immediate resuscitation after birth, and experience feeding difficulties and hypothermia (Bartal et al., 2021). The relative risk of mortality among LPIs is very low; however, the risk is four times greater for LPIs than for term infants (Williams & Pugh, 2018). Causes of mortality in this population include respiratory distress, pneumonia, perinatal asphyxia, and sepsis (Williams & Pugh, 2018). Each of these comorbidities is addressed in this Evidence-Based Clinical Practice Guideline. The referenced rationales and quality-of-evidence rating statements provide details regarding the significance of each risk factor and support for the clinical practice recommendations presented. Consistent with the AWHONN Conceptual Model for Optimizing Late Preterm Infant Outcomes, parenting issues and parental preparation to care for the LPI are also presented in this Guideline. The recommendations and accompanying rationales highlight the importance of the family's role in minimizing the risk of complications following hospital discharge.

RISK FACTORS

Identifying risk factors may help to identify pregnancies at increased risk for late preterm birth and LPIs at increased risk for comorbidities. Preterm birth occurs disproportionately among communities of color. Christian et al. (2021) found that Black birthing parents have higher rates of preterm delivery as compared with White birthing parents, at 28.2% and 14.3%, respectively. Shorter gestation was compounded by poor sleep patterns and depressive symptoms (Christian et al., 2021). Researchers found an intergenerational risk for preterm birth among non-Hispanic Black birthing parents (Ncube et al., 2017; Smid et al., 2017). That is, non-Hispanic Black birthing parents who were themselves born preterm are at higher risk for giving birth prematurely compared with non-Hispanic White birthing parents who were born prematurely (Smid et al., 2017).

Other factors increasing the risk for late preterm birth include gestational parent age of older than 40 or younger than 20 years, gestational diabetes, gestational hypertension, and preeclampsia (Bublitz et al., 2020; Kahveci et al., 2018). Prenatal complications increase the risk of LPI comorbidities, including chorioamnionitis, premature rupture of membranes, hypertension, preeclampsia, diabetes, and smoking (Bonnevier et al., 2018; Williams & Pugh, 2018). People achieving pregnancy through artificial reproductive technology demonstrated an increased rate of late preterm delivery (8.3%) compared with those without fertility complications (4.3%; Wang et al., 2019).

NEURODEVELOPMENTAL ISSUES

The potential for both short- and long-term cognitive, behavioral, and developmental problems continues to be a threat to the health of LPIs (Morgan & Boyle, 2018). Significant brain development occurs during the last 4 to 6 weeks of pregnancy. An infant born during this period is born with less central gray matter and smaller cerebellum size than those born full-term (Favrais & Saliba, 2019). Additionally, larger subarachnoid spaces, delayed cortical folding, and reduced myelination are associated with significantly poorer neurodevelopmental outcomes when compared with full-term infants (Favrais & Saliba, 2019). With fewer sulci and gyri, the brains of LPIs are approximately two thirds the size of infants born at term (Williams & Pugh, 2018).

A growing body of research is clarifying the effect of late preterm birth on neurodevelopmental outcomes. LPIs are at three times greater risk of cerebral palsy compared with full-term infants (Williams & Pugh, 2018) and have two to three times the risk of IQ scores below 85. Late preterm children demonstrate altered verbal inhibitory control and short-term verbal memory, lower prereading skills and vocabulary, and speech delays (Jois, 2018; Martinez-Nadal & Bosch, 2021). Growth rates of LPIs contribute to lifelong outcomes. LPIs with slow infant growth rates are at greater risk of requiring additional support in school, and they achieve poorer grades in primary education when compared with faster-growing LPIs (Sammallahti et al., 2017). As adults, slow-growing LPIs demonstrate lower intelligence and executive functioning (Sammallahti et al., 2017). Although being born late preterm does not alone qualify for early intervention services, researchers have found a higher rate of intervention

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referrals during childhood in this population (Woythaler, 2019). Late preterm birth has also been associated with poorer social and behavioral outcomes compared with neonates born at full term, as noted by higher rates of attention-deficit hyperactivity disorder and teacher-reported behavioral problems, higher scores on behavioral and emotional syndrome scales, and higher risk of somatic complaints (Woythaler, 2019).

GLOSSARY OF TERMS

Acute bilirubin encephalopathy is bilirubin toxicity that is displayed in acute clinical nervous system symptoms (Blackburn, 2018).

Anthropometric measures include weight, height, body mass index, body circumference (arm, waist, hip, and calf), waist-to-hip ratio, elbow amplitude, and knee–heel length.

Antibiotic stewardship describes the effort to measure and improve how antibiotics are prescribed by clinicians and used by patients. Improving antibiotic prescribing and use is critical to effectively treat infections, protect patients from harm caused by unnecessary antibiotic use, and combat antibiotic resistance (CDC, 2023).

Appropriate for gestational age indicates that a newborn's birth weight falls between the 10th and 90th percentiles.

Chestfeeding is a term used by some transmasculine and nonbinary parents to describe how they feed and nurture their children from their bodies.

Direct breastfeeding refers to feeding a newborn at the breast or chest, as opposed to feeding the lactating parent's own milk via another device, such as a bottle.

Early intervention is a multidisciplinary team approach to identifying and caring for developmental issues and medical complications using counseling as a key intervention component.

Early-onset sepsis (EOS) is indicated by a bacterial pathogen-specific positive blood or cerebrospinal fluid culture within 72 hours after birth (Arora et al., 2019; Puopolo et al., 2018; Simeonova, 2021).

EOS calculator is a web-based, multivariate risk assessment application that includes an algorithm that individualizes the infant's risk for EOS based on risk factors and clinical conditions within the first 12 hours of life (Glaser et al., 2021; Helmbrecht et al., 2019; Kuzniewicz et al., 2017).

Gestational age is the number of completed weeks of gestation from the first day of the last menstrual period to the day of birth.

Hand expression is manual massage and compression of the breasts to release human milk.

Human milk is a parent's own milk or the milk expressed from the lactating person.

Hyperbilirubinemia is an increased level of bilirubin caused by increased production of bilirubin, or decreased clearance of bilirubin, or both. There is no consistent definition of the diagnostic range that constitutes hyperbilirubinemia (Kemper et al., 2022).

Hyperthermia is a neonatal axillary temperature above 37.5°C (99.5°F).

Hypoglycemia is a relative imbalance between the supply and utilization of glucose, as evidenced by a low blood or plasma glucose concentration (Wight et al., 2021).

Hypothermia is a neonatal axillary temperature below 36.5°C (97.7°F).

Intensive phototherapy involves a spectral irradiance of at least 30 microwatts per square centimeter per nanometer delivered over as much body surface area as possible (Kemper et al., 2022).

Intrauterine growth restriction (also called **fetal growth restriction**) is a term for a condition in which a fetus has not reached its intrauterine growth potential.

Kernicterus is a condition caused by chronic bilirubin toxicity and resulting in permanent and usually irreversible neurologic damage (Kemper et al., 2022).

Large for gestational age indicates a newborn with a birth weight above the 90th percentile.

Late-onset sepsis presents after 72 hours of life and is typically acquired horizontally from the newborn's environment, though it can result from a delayed presentation of vertically acquired maternal pathogens (Glaser et al., 2021).

Neutral thermal environment is an environmental temperature that minimizes caloric expenditure while maintaining core temperature within a normal range (Brand & Shippey, 2021).

Pasteurized donor human milk is human milk that has been donated by other parents, which is screened and heat-treated before use.

Phototherapy is light therapy (preferably in the strongest form with blue light spectrum lights) to lower the bilirubin concentration in the blood by decomposition of the bilirubin (Blackburn, 2018).

Severe neonatal morbidity is defined by the presence of at least one of the following elements: Apgar score below 4 at 5 minutes, severe respiratory distress requiring respiratory support, severe neonatal acidosis, and admission to the neonatal intensive care unit (Mengistu et al., 2021).

Skin-to-skin refers to holding an unclothed newborn on a parent or caretakers' bare chest, usually in an upright position.

Small for gestational age indicates a newborn's birth weight below the 10th percentile.

Sudden unexpected postnatal collapse is the unexpected collapse of a healthy newborn's respiratory or cardiac status or both, generally occurring within a few hours to days following birth.

Thermal synchrony is a phenomenon in which the temperature of the postpartum person's chest increases or decreases to warm or cool the infant while in a skin-to-skin position.

Thermoregulation is the biological mechanism responsible for maintaining a steady internal body temperature.

Total serum bilirubin is the amount of bilirubin that is in the blood, calculated by obtaining a blood sample (Blackburn, 2018).

Transcutaneous bilirubin is a noninvasive method to screen for jaundice with a device that measures the light density or light reflected, predicting the level of bilirubin (Blackburn, 2018).

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Common Inclusive Language Used in AWHONN Educational Products and Activities

Although the words "woman," "women," and "mother" and related pronouns are used herein, AWHONN recognizes the existence of diverse gender identities and acknowledges that not all individuals who present for care self-identify as women or exclusively as women. When referencing the published results of previous studies, terms used by the original authors are retained for accuracy. To provide appropriate, respectful, and sensitive care, the health care provider is encouraged to always ask individuals what words they use to describe themselves, their bodies, and their health care practices.

Evidence-Based Recommendations and Rationales

Parent Readiness and Support

Recommendation (PR1): Prior to birth, communicate to parents and support people the potential complications and interventions in caring for LPIs.

Rationale: Because of their immature organs and systems, LPIs are at risk for a variety of complications, including but not limited to thermal instability, respiratory distress, sudden infant death syndrome (SIDS), feeding challenges, hypoglycemia, hyperbilirubinemia, sepsis, and neurodevelopmental issues. Parent education should focus on these risk factors (American Academy of Pediatrics [AAP] & American College of Obstetricians and Gynecologists [ACOG], 2017: VI; Anderson & Narvey, 2022: VII; Engle et al., 2007: VII).

Recommendation (PR2): Teach parents and validate their understanding about the special health needs of LPIs affecting their care throughout their hospital stay. These include but may not be limited to the following:

a. Signs of respiratory distress
b. Interventions that support a neutral thermal environment
c. Strategies to prevent infection
d. Importance of human milk and feeding issues
e. When to alert the health care team

Rationale: Parents often require more anticipatory guidance related to the challenges meeting the physiologic needs of LPIs, including signs of respiratory distress, thermal support, prevention of infection, providing human milk, and when to contact the pediatric care provider. LPIs are born during the stage of lung development when remodeling of the alveoli and bronchiole occurs. Surfactant synthesis and secretion are also affected, predisposing LPIs to respiratory distress syndrome (Verklan, 2021: VII). Therefore, it is important to ensure parents understand and recognize the signs of respiratory distress.

LPIs are at high risk for thermal instability because of increased surface-area-to-body-mass ratio, decreased brown adipose tissue and subcutaneous fat, nonkeratinized thin skin, immature response to temperature receptors, decreased glycogen stores and ability to convert stored glycogen, and neuromuscular immaturity (Brand & Shippey, 2021: VI). As temperature regulation stabilizes, the focus of parent education may be redirected from hypothermia identification and management to prevention of hypothermia (Goodstein, 2021: VII). Head coverings, including hats, contribute to overheating and are not recommended indoors except in the first hours of life as temperature stabilizes or in the NICU environment (Goodstein, 2021: VII; Moon et al., 2022: VI).

At birth, the newborn's innate immune system is underdeveloped and the acquired immune system is insufficient, placing all newborns at risk for infection for the first several months as their immune systems continue to develop. Newborns may also have a limited ability to produce an effective antibody response (Glaser et al., 2021: VI; Grobben et al., 2022: VII; Karnati et al., 2020: VI). Contact with infected family members creates a potential for bacterial or viral transmission to the LPI. Therefore, hand hygiene and covering the nose and mouth with a mask are recommended when an infected caregiver or other person is in contact with the LPI (Meek & Noble, 2022: VII).

Breastfeeding is facilitated by providing parents with education and support (Carpay et al., 2021: V). To support the transition to breastfeeding in the home environment, education about the benefits of human milk should begin on admission, continue throughout hospitalization, and be reviewed on discharge (Goodstein, 2021: VII). Breastfeeding or offering human milk provides newborns with passive immunity through maternal antibodies that are present in the breast milk. Maternal antibodies are transferred into the milk via receptors on endothelial cells. Breastfed infants have fewer respiratory infections and a lower mortality risk than infants who receive formula (Grobben et al., 2022: VII).

Recommendation (PR3): Encourage parent(s) to advocate for their LPI by requesting the following:

a. Rooming-in for stable LPIs
b. Immediate and sustained skin-to-skin (STS) contact at birth, before feeding, and while in the hospital
c. Early support with providing human milk or milk expression, if needed
d. An early evaluation with a lactation consultant
e. Education and modeling of safe sleep practices
f. In-hospital family presence

Rationale: The family is a crucial part of the care team. Inclusion in the care of the newborn promotes confidence, decreases anxiety, and increases resilience, thereby facilitating parent confidence and promoting a safe discharge environment (Anderson & Narvey, 2022: VII). Parent–infant relationships affect newborn development. In successful parent–infant interactions, the parent and the infant modify their behaviors depending on the feedback provided by one another (Helmer et al., 2021: VI). Parents should be sensitive to the

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newborn's cues and should aim to read, interpret, and respond to the cues promptly and accurately to develop a well-functioning parent–infant relationship.

Mothers and fathers react differently to parenting a preterm infant, suggesting a gendered nature of parenthood. Whereas fathers experience higher overall stress, mothers report social isolation and lack of support from their partners. Fathers' concerns center on the well-being of the mother, whereas mothers worry about their baby (Premji et al., 2019: VI). Fathers of LPIs found fatherhood to be a very positive experience but worried about keeping the infant safe, the infant's risk for developmental problems, and providing for the family. Their risk for elevated depressive symptoms did not differ from that of fathers of full-term infants (Carson et al., 2015: IV). Fathers also lacked self-confidence about parenting LPIs (Benzies & Magill-Evans, 2015: QII), although mothers did not (Baker et al., 2013: IV).

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Gestational Age

Recommendation (GA1): Determine the newborn's gestational age with an obstetric estimate using the best available data, which may include:

a. last menstrual period (LMP) and
b. prenatal ultrasound results.

Rationale: Because the late preterm population is at increased risk for morbidity and mortality, accurate determination of gestational age is important to assist in identifying risk factors (ACOG, 2017a: VI; ACOG, 2017b: VI; Baer et al., 2019: IV). The AAP recommends using consistent terms to describe the newborn's length of gestation and age to compare neurodevelopmental, medical, and growth outcomes (AAP, 2004/2021: VI). The National Center for Health Statistics has transitioned from basing pregnancy dating on the LMP to the best obstetric estimate, which is determined by all perinatal factors, including an ultrasound examination. The obstetric estimate has been shown to have greater validity when compared with the LMP-based measure (ACOG, 2017b: VI; Martin et al., 2015: IV).

When the LMP is unknown, dating of the pregnancy should be based on an ultrasound evaluation, preferably performed during the first trimester (ACOG, 2017a: VI; ACOG, 2017b: VI). The most accurate method for estimating gestational age in pregnancies that are not achieved through assisted reproductive technology is an ultrasound examination obtained during the first trimester (ACOG, 2017a: VI; ACOG, 2017b: VI; Baqui et al., 2017: IV; Kullinger et al., 2016: IV).

Ultrasonography performed before 13 weeks and 6 days of gestation that identifies a crown–rump length consistent within 5 days of the estimated date of birth by last LMP confirms the accuracy of the LMP as the actual due date. However, if the crown–rump length suggests a gestational age that is 6 or more days greater or less than the estimated date of birth based on the LMP, the ultrasound finding is then considered to be the accurate estimated date of birth (ACOG, 2017a: VI; ACOG, 2017b: VI). Ultrasonography performed between 16 and 22 weeks of gestation that identifies a crown–rump length consistent within 10 days of the estimated date of birth by the LMP confirms the LMP as the actual due date. However, if the crown–rump length suggests a gestational age of 11 or more days greater or less than the estimated date of birth based on the LMP, the ultrasound finding is then considered to be the accurate estimated due date (ACOG, 2017a: VI; ACOG, 2017b: VI; Spong, 2013: VII). Any pregnancy without an ultrasound evaluation to confirm or revise the estimated due date before 22 and 0/7 weeks of gestation should be considered suboptimally dated (ACOG, 2017a: VI; Kelley et al., 2016: VI).

Recommendation (GA2): If the pregnancy dating is suboptimal or there is a discrepancy in the expected gestational age, perform postnatal gestational assessment using an appropriate scoring tool (e.g., New Ballard Score [NBS]).

- **Ideally, complete the NBS prior to 12 hours of age.**

Rationale: Newborn assessment for gestational age dating has become less relevant in high-income settings, where ultrasound coverage is available and uncertainty of antenatal pregnancy dating is less common than in low- and middle-income countries (Lee et al., 2017: I). The NBS is the recommended gestational age assessment tool when needed. The NBS has been identified as an accurate means of determining gestational age to within 1.58 weeks of the LMP (Ballard et al., 1991: VI; Lee et al., 2017: I). However, the NBS may overestimate gestational age in preterm newborns of 32 to 37 weeks of gestation (Ballard et al., 1991: VI; Lee et al., 2017: I), and its accuracy depends on the skill of the examiner and the newborn's condition (Das et al., 2018: IV). Accuracy is improved when both the physical and neurologic components of the NBS are completed (Gagliardi et al., 1992: VI). The NBS examination has been proven to be valid until 7 days of age, with assessment of neurologic signs of maturity being more accurate than physical signs of maturity (Karl et al., 2015: IV; Sasidharan et al., 2009: IV). However, the validity of the NBS increases when it is completed prior to 12 hours of age.

Recommendation (GA3): Obtain the LPI's length, weight, and head circumference and plot the measures on the growth chart to classify the newborn as follows:

a. Small for gestational age (SGA)
b. Appropriate for gestational age (AGA)
c. Large for gestational age (LGA)

Note: Ideally, measurements should be plotted on a growth curve validated for preterm newborns, such as the Fenton Growth Chart.

Rationale: In addition to gestational age, risk for morbidity is also determined by assessment of the nature and quality of intrauterine growth and development, described as follows. The anthropometric measurements commonly assessed in the newborn are weight, length, and head circumference. Standard values for these three measurements are well established (Meldere et al., 2013: IV). Anthropometric measurements can be used as a surrogate or in addition to the NBS to improve the accuracy of gestational age

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estimation (Baqui et al., 2017: VI; Das et al., 2018: VI; Siyah Bilgin et al., 2018: VI). The Fenton Growth Chart is one of the commonly used reference charts that is based on size at birth. The Fenton Growth Chart is a validated, sex-specific instrument that can be used to assess size for gestational age of preterm neonates born at less than 37 weeks, with continued use to assess growth up to 50 weeks post–menstrual age (Fenton & Kim, 2013: I; see Appendices GA-A and GA-B).

Awareness of the neonate's size for gestational age allows the care provider to assess additional risk factors that accompany intrauterine growth restriction (IUGR) or macrosomia (Bassan et al., 2011: IV). Research has demonstrated that SGA and IUGR neonates tend to have higher rates of mortality than AGA neonates, particularly those at lower gestational ages (Mallick et al., 2019: IV; Williams & Pugh, 2018: VII), and are more likely to experience complications such as intraventricular hemorrhage (Kugelman & Colin, 2013: V) and hypoglycemia (van Kempen et al., 2020: II; Williams & Pugh, 2018: VII). LGA neonates are at increased risk for severe hyperbilirubinemia (Bhutani & Johnson, 2006: IV), as well as birth trauma and hypoglycemia (Cummings et al., 2022: IV; van Kempen et al., 2020: II).

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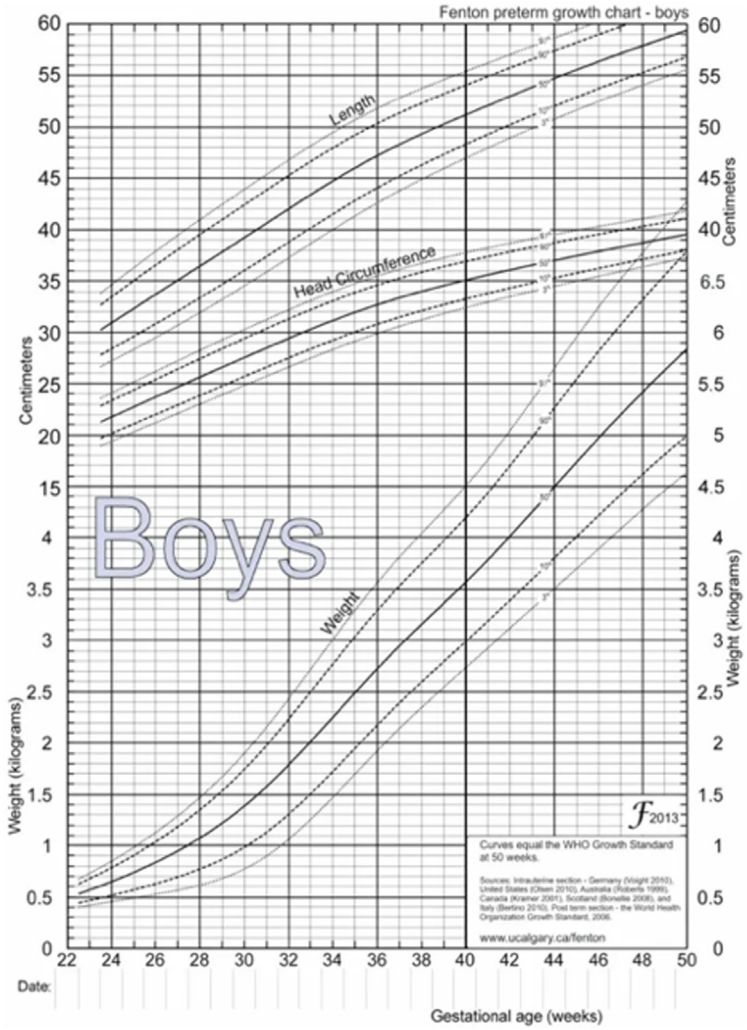
APPENDIX GA-A. FENTON GROWTH CHART FOR BOYS



Note. From "A Systematic Review and Meta-analysis to Revise the Fenton Growth Chart for Preterm Infants," by T. R. Fenton & J. H. Kim, 2013, *BMC Pediatrics*, 13(1), Article 59 (https://doi.org/10.1186/1471-2431-13-59).

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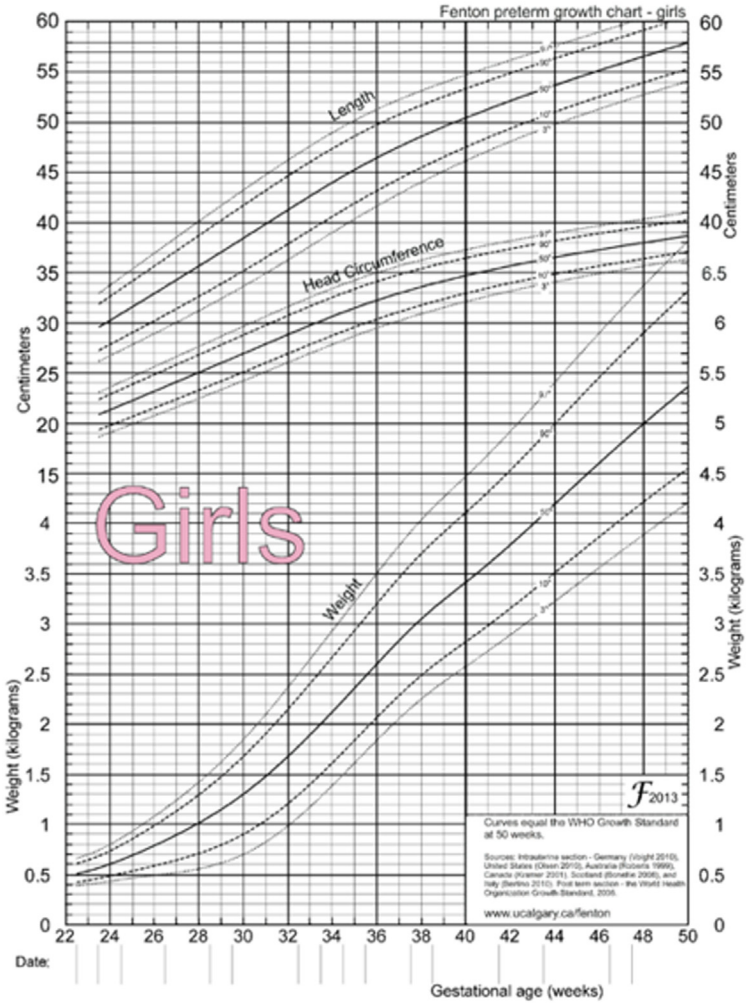
APPENDIX GA-B. FENTON GROWTH CHART FOR GIRLS



Note. From "A Systematic Review and Meta-analysis to Revise the Fenton Growth Chart for Preterm Infants," by T. R. Fenton & J. H. Kim, 2013, *BMC Pediatrics*, 13(1), Article 59 (https://doi.org/10.1186/1471-2431-13-59).

Respiratory Care

Being born early interrupts normal lung development, and maternal and newborn risk factors may adversely affect the developing respiratory system. LPIs are more vulnerable to a range of respiratory illnesses, including respiratory distress syndrome and transient tachypnea of the newborn, and more likely to need assisted ventilation than term newborns (Correia et al., 2018). Respiratory distress is the most common morbidity in the LPI (Sahni & Polin, 2013). The goals of treatment are to provide support until the respiratory symptoms resolve and to prevent further lung injury (Verklan, 2021).

Recommendation (RC1): Review perinatal and intrapartum history for maternal and fetal factors that could increase the risk for respiratory distress.

a. **Maternal conditions include but are not limited to chorioamnionitis (also identified as intrauterine infection, or inflammation, or both, or triple I), gestational diabetes, operative or cesarean birth, and maternal peripartum antibiotics.**
b. **Neonatal conditions include but are not limited to low Apgar scores, male sex, lower gestational age, and multiple-gestation pregnancy.**

Rationale: Reviewing risk factors will help identify LPIs who may be at greater risk for respiratory illness. Many fetal and maternal risk factors impact respiratory status after birth. A retrospective cohort study of newborns at gestational ages from 34 weeks to 38 weeks and 6 days found that preexisting maternal diabetes mellitus, instrumental birth, and emergency cesarean birth for nonreassuring fetal status increased the risk for severe neonatal morbidity in LPIs (Mengistu et al., 2021: IV).

An additional retrospective cohort study found that pregestational diabetes increased the risk for an Apgar score of less than 7 at 5 minutes, assisted ventilation for more than 6 hours, surfactant use, and NICU admission in the LPI population (Tse et al., 2020: IV). Lower-gestational-age newborns (34–36 weeks of gestation) had a higher risk for severe neonatal morbidity (Tse et al., 2020: IV). A descriptive retrospective study of LPIs born at a single center found respiratory morbidity to be significantly higher in LPIs who were born at a lower gestational age, were male gender, were born via cesarean, were born to nulliparous mothers, or were exposed to peripartum antibiotics (Correia et al., 2018: IV). Cesarean delivery and resuscitation with an endotracheal tube were independent risk factors for respiratory morbidity in this population (Correia et al., 2018: IV).

A large, retrospective cohort study comparing the differences in morbidity between singleton LPIs and twin LPIs found that LPI twins had significantly higher rates of respiratory distress syndrome, intraventricular hemorrhage, necrotizing enterocolitis, and sepsis at lower gestational ages. By 36 weeks of gestation, the risk of respiratory distress syndrome was the only complication that remained higher in the LPI twin group. Although the researchers did not find a significant difference in mortality between LPI twins and singletons, there was a significant difference in morbidity in the LPI twin group (Ward & Caughey, 2022: IV).

Recommendation (RC2): Recognize that exposure to antenatal corticosteroids may improve respiratory symptoms.

Rationale: Some factors may enhance fetal lung development and prevent respiratory complications. Prophylactic administration of antenatal steroids can help decrease respiratory morbidity in LPIs and potentially reduce the need for respiratory support and admission to the NICU. A meta-analysis of seven studies of outcomes for LPIs showed a reduction in the need for respiratory support when women received antenatal corticosteroids (Deshmukh & Patole, 2021: I). The study also found that the administration of antenatal corticosteroids may increase the risk of hypoglycemia. Additionally, there was a decrease in respiratory distress syndrome and transient tachypnea of the newborn in those exposed to antenatal corticosteroids; however, the decrease was not significant. Researchers suggest more studies are needed to assess neurodevelopmental outcomes after exposure to antenatal corticosteroids in this population (Deshmukh & Patole, 2021: I).

Recommendation (RC3): Assess respiratory status immediately after birth.

a. **Assess the respiratory rate every 30 minutes until the newborn's condition has remained stable for 2 hours. Count the respiratory rate for 1 full minute. The respiratory rate for newborns should be between 30 and 60 breaths per minute**.
b. **Respirations may be irregular during the first 15 minutes of life, with the respiratory rate reaching 60 to 80 breaths per minute and may be up to 100 breaths per minute for a limited time.**
c. **Note signs of increased work of breathing, such as retractions, grunting, nasal flaring, tachypnea, tachycardia, and asymmetrical chest movement.**

Note: Respiratory assessment may occur while the newborn is in STS contact.

Rationale: LPIs have an increased risk for respiratory distress and respiratory morbidity because of immature control of breathing, lower surfactant levels, and immature lung development with a smaller size and number of alveoli (Blackburn, 2018: VII). Assessing

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respiratory status immediately after birth helps identify LPIs who need early respiratory support. Most moderate-to-late preterm infants with respiratory morbidity are treated with noninvasive ventilation in the birthing room (Debillon et al., 2021: I). Initial newborn assessments can be completed while the stable LPI is in STS contact. STS contact may help to protect the LPI against "hypothermia-induced apnea" (Phillips et al., 2013, p. S5: III). Frequent monitoring is required until the newborn's overall condition becomes stabilized (AAP & ACOG, 2017: VI; Weiner & Zaichkin, 2021: VI). Once the LPI is stable, the timing of respiratory assessment should be individualized based on the risk factors present. Normal respiratory effort can vary with the newborn's activity; the expected range is 30 to 60 respirations per minute with no signs of increased work of breathing (Tappero, 2021: VI).

All preterm newborns are at risk for irregularities in respiratory patterns, such as apnea, increased work of breathing, and tachypnea. LPIs born by cesarean birth are at increased risk for respiratory issues, including higher respiratory rates, especially during transition after birth (Horgan, 2015: VI). Apnea occurs more often in LPIs than in term newborns because of their immature lung structure and functional capacity as well as central nervous system immaturity (Verklan, 2021: VI).

Early recognition of a complicated neonatal transition to extrauterine life in LPIs is important to help ensure timely intervention and decrease both short- and long-term morbidity at this precarious time of life (AAP & ACOG, 2017: VI). For example, anemic hypoxia, characterized by a decrease in available hemoglobin to transport oxygen to the newborn, results in increased depth and frequency of respirations in an attempt to increase oxygen transport to the blood (Blackburn, 2018: VII).

See "Thermoregulation" in this Guideline for more information.

Recommendation (RC4): If respiratory distress symptoms such as tachypnea, retractions, nasal flaring, grunting, decreased perfusion, or cyanosis are present, implement appropriate interventions, such as the following:

- **a. Provide a supplemental heat source, such as STS contact, a radiant warmer, an incubator, or chemical thermal mattress.**
- **b. Assist with the administration of respiratory therapies as ordered, which may include:**
  - **supplemental oxygen,**
  - **continuous positive airway pressure, or**
  - **mechanical ventilation.**
- **c. Ensure oxygen is heated and humidified.**
- **d. Apply a pulse oximetry monitor (range should be between 91% and 95%).**
- **e. Provide blood pressure monitoring.**
- **f. Check blood serum glucose levels.**

Note: Consider transferring to a higher level of care if indicated.

Rationale: Ensuring early assessment and intervention for LPIs with respiratory distress symptoms may help to improve short- and long-term outcomes. A large, prospective cohort study showed that respiratory symptoms occurred at an average age of 1.8 hours after birth in LPIs with primary respiratory diagnoses of transient tachypnea of the newborn, pneumonia, or aspiration (Kitsommart et al., 2016: IV). Alterations in environmental temperature and body temperature (hypo- or hyperthermia) may increase metabolic demands, leading to tachypnea; decrease surfactant production; or increase symptoms of respiratory distress (Blackburn, 2018: VII; National Association of Neonatal Nurses [NANN], 2021: VI). Providing a supplemental heat source will promote a neutral thermal environment. Body temperature, metabolism, and oxygen consumption are closely related (Blackburn, 2018: VII). Hypothermia may lead to worsening respiratory symptoms, including hypoglycemia, respiratory distress, brain injury, and increased mortality (Aziz et al., 2021: VI).

Oxygen supplementation may decrease the overall work of breathing and improve outcomes. A large, prospective cohort study of infants born between 34 weeks and 0 days and 36 weeks and 6 days of gestation found that half of the LPIs presenting with respiratory distress symptoms needed positive pressure ventilation and were 4.2 times more likely to require intubation than full-term infants (Kitsommart et al., 2016: IV). Except for emergency situations, air–oxygen mixtures should be warmed and humidified (Aziz et al., 2021: VI). Pulse oximetry measures oxyhemoglobin saturation and is a bedside screening tool used as an adjunct to arterial blood gas sampling. The optimal range for oxygen saturation has not been defined for preterm infants (AAP & ACOG, 2017: VI). Recent studies show an increase in mortality in preterm infants with oxygen saturation ranges between 85% and 89% when compared with the target range of 91% to 95% (Kayton et al., 2018: VI).

An escalation in respiratory demands in preterm infants may increase the risk of hypoglycemia (Sahni & Polin, 2013: VI). Preterm infants have decreased glycogen stores and are more challenged than term infants when faced with altered metabolic demands from tachypnea, respiratory distress, or hypothermia (Blackburn, 2018: VII). LPIs presenting with symptoms of respiratory distress are 7.3 times more likely to need care in a NICU environment than full-term infants with similar symptoms (Kitsommart et al., 2016: IV). It is important to monitor the LPI closely and plan for early transfer if indicated.

Recommendation (RC5): Complete and document a detailed newborn clinical examination and continue to monitor respiratory status.

- **a. Monitor respiratory rate, type of respirations, tone, and activity at least every 30 minutes until the newborn's condition has remained stable for 2 hours.**
- **b. Continue respiratory status assessment at least every 4 hours for the first 24 hours and then once per shift with routine assessments.**

c. **Monitor heart rate, perfusion, and muscle tone at least every 4 hours for the first 24 hours of life and then once per shift with routine assessments.**
d. **Maintain a neutral thermal environment.**

Note: More frequent assessments may be needed and should be individualized.

Rationale: Although premature newborns may react similarly to the challenges of adapting to extrauterine life as term newborns, they are at greater risk for a complicated transition (AAP & ACOG, 2017: VI; Aziz et al., 2021: VI). Pulmonary circulation has not matured enough to effectively manage the exposure to oxygen in preterm infants (Kayton et al., 2018: VI). The LPI may have delayed respiratory transition. Following professional organization and institutional guidelines helps to ensure adequate respiratory assessment and minimize respiratory complications during transition (AAP & ACOG, 2017: VI; Verklan, 2021: VI). Complications in the LPI population can arise after birth, during the hospital stay, or after discharge, resulting in the need for close monitoring (Verklan, 2021: VI). A neutral thermal environment helps the LPI maintain energy, glucose, and oxygen balance, which promotes a healthy respiratory state (Blackburn, 2018: VII).

References for Respiratory Care

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Thermoregulation

Newborns who have a high skin-surface-to-weight ratio, reduced capacity for metabolic heat production, and high evaporative heat loss are at an increased risk for cold stress (NANN, 2021). LPIs are at higher risk for thermal instability because of increased surface-area-to-body-mass ratio, decreased brown adipose tissue and subcutaneous fat, nonkeratinized thin skin, immature response to temperature receptors, decreased glycogen stores and ability to convert stored glycogen, and neuromuscular immaturity (Brand & Shippey, 2021).

Recommendation (T1): Review prenatal and intrapartum history that could increase the risk for heat loss, cold stress, or hyperthermia (see Table T-1).

TABLE T-1 RISK FACTORS FOR ALTERED THERMOREGULATION

Prenatal/Intrapartum	Neonatal
• Hypertension • Substance use disorder • Cesarean birth • Maternal fever • Prolonged rupture of membranes • Intraamniotic infection	• Early gestational age • IUGR • SGA • Neonatal withdrawal syndrome • Lower Apgar scores • Need for resuscitation

Rationale: To prevent alterations in thermoregulation in LPIs, it is important to be aware of the maternal and neonatal risk factors that impact these processes. Maternal risk factors such as hypertension and substance use disorder may impact placental function and lead to preterm birth. Newborns exposed to these maternal factors are at risk for decreased birth weight, lower Apgar scores, increased need for resuscitation, and neuronal injury, which predisposes them to hypothermia (Patrick et al., 2020: VII; Shviraga & Henseley, 2021: VII). Newborns may experience neonatal opioid withdrawal syndrome with passive exposure to prescription medications or illicit substances, which may result in premature birth, low birth weight, temperature instability, and other physiologic side effects (D'Apolito, 2021: VII).

Cesarean birth is a risk factor for hypothermia because of the operating room environmental factors (e.g., radiation, conduction, and convection) and the interference of anesthesia with the normal mechanisms of maternal thermoregulation (Griffiths et al., 2018: I). Intraamniotic infection is a common condition noted in both term and preterm neonates and is associated with neonatal morbidity. Prolonged labor, prolonged rupture of membranes, multiple cervical examinations, and the use of invasive devices in labor are common causes of infectious etiology (Brand & Shippey, 2021: VI), while intrapartum fever may be a sign of maternal infection. The diagnosis of suspected intraamniotic infection is made when the laboring patient's temperature is greater than 39°C (102.2°F) or between 38.0°C and 38.9°C (100.4°F–102.02°F) and one additional clinical risk factor is present (ACOG, 2017: VII).

Recommendation (T2): Assess parents' knowledge of the benefits of immediate and frequent STS contact.

Rationale: Ideally, education on STS contact should be provided in the prenatal period; however, a review of the knowledge of the pregnant person and their support person about STS practices should be undertaken on admission to the labor unit (Widström et al., 2019: VI). Parent and family education should include discussion of short- and long-term benefits of STS for the newborn and the benefits of participation by parents and other family members (AWHONN, 2021: VI). There are limited studies of the impact of STS contact in LPIs (Lilliesköld et al., 2022: VI). Parents should be provided with information about the need to monitor the newborn's position and breathing during STS contact (Widström et al., 2019: VI).

Recommendation (T3): Immediately after birth, initiate actions to maintain and promote a neutral thermal environment.

Rationale: Cold stress stimulates the release of norepinephrine, which increases the metabolic rate, consumption of oxygen, and use of glucose. Increased oxygen consumption may lead to hypoxemia and hypoxia (Verklan, 2021: VII). For all newborns, core body temperature drops 2°C–3°C (3.6°F–5.4°F) in the first 30 minutes following birth (NANN, 2021: VI). Initial actions of ensuring a warm environment that is free of drafts, drying wet skin with warmed blankets, placing a dry hat on the newborn's head, and uninterrupted STS contact for at least the first hour following birth reduce heat loss from evaporation, conduction, convection, and radiation (AAP & ACOG, 2017: VI; Andrews et al., 2018: IV; Pappas & Robery, 2021: VII; Weiner & Zaichkin, 2021: VI).

Recommendation (T4): Facilitate immediate, continuous STS contact after vaginal or cesarean birth and continue without separation, whenever possible.

a. **Encourage uninterrupted STS contact for at least the first hour of life or until feeding is complete.**
b. **Delay nonurgent tasks until the initial STS session is complete.**
c. **Avoid routine parent and newborn separation.**

Note: A partner or family member may provide STS contact if the gestational parent is unable to.

Rationale: STS contact is a recommended intervention to maintain body temperature after birth; it reduces energy expenditure while promoting physiologic regulation of the newborn and psychological benefits for the parents (AAP & ACOG, 2017: VI; AWHONN, 2019: VI; AWHONN, 2021: VI; Walsh et al., 2021: V1; Wight et al., 2021: IV). Delaying nonurgent tasks during the initial newborn transition increases the opportunity for STS contact and prevents parent and newborn separation. Temperature is regulated during STS contact through the process of thermal synchrony (Neczypor & Holley, 2017: VI), which improves metabolic function with decreased hypoglycemia (Chiruvolu et al., 2017: VI; Moore et al., 2016: I). STS contact during a cesarean birth is associated with increased maternal confidence and a positive and satisfying birth experience (Bertrand & Adams, 2020: VI) as well as the establishment and maintenance of breastfeeding (AAP & ACOG, 2017: VI; AWHONN, 2021: VI; Chirulvolu et al., 2017: VI; Crenshaw, 2019: VI; Ludington-Hoe & D'Apolito, 2021: VII; Moore et al., 2016: I; Wight et al., 2021: IV). The practice of rooming-in throughout the hospital stay promotes a greater opportunity for STS contact and parent–infant interaction (AAP & ACOG, 2017: VI; AWHONN, 2021: VI; Moore et al., 2016: I).

Recommendation (T5): Educate parents about and ensure safe parent and newborn positioning, as well as appropriate staff availability, during STS contact (see Table T-2).

Rationale: Sudden unexpected postnatal collapse (SUPC) is associated with a high risk of morbidity and mortality (Anderson et al., 2021: IV). Proper positioning and adequate supervision of newborns during STS contact may decrease the risk of adverse outcomes (Anderson et al., 2021: IV; AWHONN, 2019: VI; AWHONN, 2020: VI). Close monitoring of newborns during STS contact during the recovery period (initial 2 hours after birth) by provider or nursing personnel is recommended to reduce preventable newborn harm (AAP & ACOG, 2017: VI; Addison & Ludington-Hoe, 2020: V1; Anderson et al., 2021: IV; AWHONN, 2021: VI; AWHONN, 2022: VI).

TABLE T-2 SAFE POSITIONING FOR STS CONTACT

I. Position of the parent
- Semi-upright and supported. *Note: Parent positioning immediately after birth may be adjusted based on type of birth.*

II. Position of the newborn
- Prone, on parent's bare chest
- Head upright and turned to the side
- Neck midline and erect
- Mouth and nares visible
- Extremities flexed
- Blanket on neonate's back, no higher than shoulder level, and not covering head or face

Recommendation (T6): Provide close observation during STS contact to ensure maternal and newborn safety, including prevention of SUPC:

a. Assess LPI for signs of decreased oxygenation, cyanosis, or pallor (including mucous membranes based on skin tone) during STS sessions.
b. Monitor newborn vital signs according to facility protocol.
c. Consider using a validated tool to assess, monitor, and document the newborn's well-being during STS contact.

Note: All newborns in STS contact are at risk for SUPC.

Rationale: An analysis of the CDC's linked birth and death data suggests the total SUPC incident rate is approximately 3/100,000 live births, with an estimated 50% of SUPC cases resulting in a fatality (Anderson et al., 2021: IV). SUPC typically occurs in the initial 2 hours of life. Causes of SUPC are multifactorial and may include prone or unsafe positioning of the newborn; unsupervised STS contact; breastfeeding during STS contact; maternal fatigue, analgesia, and sedation; and distraction of caregivers (Anderson et al., 2021: IV; AWHONN, 2020: VII; Barbaglia et al., 2019: IV). Use of standardized assessment checklists or tools facilitates a consistent safety approach to monitoring STS contact (Davanzo et al., 2015: VI; Tyrala et al., 2021: VI).

Recommendation (T7): Monitor axillary temperature per facility protocol.

a. Monitor temperature within 30 minutes of life and then every 30 minutes until the newborn's condition has remained stable for 2 hours.
b. Maintain axillary temperature between 36.5°C and 37.5°C (97.7°F–99.5°F) from birth to discharge.
c. Use a servo-controlled radiant warmer with a temperature sensor or a prewarmed transport incubator or both for LPIs who are not stable.

Note: For LPIs experiencing difficulties with transition, more frequent assessment of vital signs is indicated.

Rationale: Maintaining a temperature within a normal range allows the LPI to maintain homeostasis with minimal metabolic demands (NANN, 2021: VI). Frequent monitoring is required until the newborn's temperature and overall condition stabilize (AAP & ACOG, 2017: VI; Brand & Shippey, 2021: VI; Weiner & Zaichkin, 2021: VI). Axillary temperatures correlate with rectal temperatures in gauging core body temperature (NANN, 2021: VI). Taking rectal temperature with a thermometer poses the risk of intestinal perforation and is not recommended (Brand & Shippey, 2021: VI; NANN, 2021: VI). An axillary temperature between 36.5°C and 37.5°C (97.7°F–99.5°F) is considered normothermic for LPIs (Brand & Shippey, 2021: VI; NANN, 2021: VI; Weiner & Zaichkin,

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2021: VI). When routine interventions, such as drying with warm blankets, STS contact, and early breastfeeding, are not sufficient to maintain euthermia, additional monitoring and a supplemental heat source are required (AAP & ACOG, 2017: VI; NANN, 2021: VI; Verklan, 2021: VII; Weiner & Zaichkin, 2021: VI). A constant heat source can reduce heat loss and allows access to the newborn during stabilization or resuscitation procedures, if indicated (AAP & ACOG, 2017: VI; Weiner & Zaichkin, 2021: VI).

Recommendation (T8): Assess the LPI for cold stress symptoms, including the following:

a. Tachypnea
b. Apnea
c. Color change: pallor, mottling, cyanosis
d. Lethargy
e. Poor feeding
f. Altered pulmonary vasomotor tone
g. Metabolic acidosis

Rationale: Neonatal cold stress can occur when the LPI's temperature is between 36°C and 36.5°C (97°F–98°F; NANN, 2021: VI). The increased risk for cold stress predisposes the LPI to difficulties with respiratory transition and exacerbates hypoglycemia as well as compensatory mechanisms that can lead to alterations that are difficult to reverse, such as hypoxemia, hypoglycemia, and central nervous system injury (Brand & Shippey, 2021: VI). Recognizing the symptoms of cold stress and intervening early may prevent morbidity associated with hypothermia.

Recommendation (T9): Rewarm hypothermic newborns according to facility protocol.

Rationale: To avoid respiratory depression and convulsions, slow rewarming of the newborn is recommended for the treatment of neonatal cold injury syndrome or mild hypothermia treatment of hypoxic–ischemic encephalopathy (Liu et al., 2022: VI). Slow rewarming may not be appropriate for mild and moderate hypothermia that occurs in many neonates, especially low-birth-weight, preterm neonates (Liu et al., 2022: VI). Because of the lack of strong evidence to support rapid rewarming (Liu et al., 2022: VI; Saugstad et al., 2021: VI), detailed guidelines for rewarming of preterm neonates are not available (Liu et al., 2022: VI). Therefore, it is important to use caution when rewarming, observing for apnea and hypotension related to vasodilation and increased oxygen consumption (Brand & Shippey, 2021: VI). The literature recommends that additional research be completed to determine optimal rewarming target rates (Liu et al., 2022: VI).

Recommendation (T10): Be aware of the risk factors and signs of hyperthermia. (see Table T-3)

Rationale: Hyperthermia is commonly attributed to iatrogenic or environmental factors, such as excessive swaddling or clothing, overheating from radiant warmers, and ambient environmental temperature, or it may be related to infection or neonatal sepsis (Brand & Shippey, 2021: VI). Newborns may be unable to dissipate heat caused by physiologic and environmental factors, including cardiac defects, infection, maternal fever, and drug withdrawal (Brand & Shippey, 2021: VI). Temperatures higher than 37.5°C (99.5°F) increase oxygen utilization and lead to vasodilation and dehydration, resulting in apnea, hypernatremia, irritability, poor feeding, seizures, tachycardia, neuronal injury, and death (Brand & Shippey, 2021: VI; NANN, 2021: VI). Frequent temperature evaluation and assessments are essential in the detection of thermal instability (Brand & Shippey, 2021: VI).

TABLE T-3 RISK FACTORS AND SIGNS OF HYPERTHERMIA

Risks for Hyperthermia	Signs of Hyperthermia
• Excessive swaddling • Excessive newborn clothing • Overheating on a radiant warmer • Changes in ambient temperatures • Neonatal infection • Maternal fever • Withdrawal syndromes	• Tachycardia, tachypnea, apnea • Warm extremities, flushing • Dehydration • Lethargy, hypotonia • Poor feeding • Irritability • Weak cry

Recommendation (T11): Assess the LPI's temperature at least every 4 hours for the first 24 hours and then, if stable, at least once per shift until discharge.

- **Assessment of vital signs may be individualized based on risk factors.**

Rationale: The risk of temperature instability extends beyond the first 2 hours of life. Unless preventive actions are taken, LPIs are more likely to experience disruptions in the physiologic processes that maintain thermoregulation when compared with term newborns (Weiner & Zaichkin, 2021: VI). LPIs need frequent monitoring until the newborn's temperature and overall condition stabilize (AAP & ACOG, 2017: VI; Verklan, 2021: VI; Weiner & Zaichkin, 2021: VI).

Recommendation (T12): Continue to take measures to ensure a neutral thermal environment by avoiding heat loss or overheating.

a. Maintain parent–infant contact and continue to encourage STS contact.
b. Encourage rooming-in, breast- or chestfeeding, and safe sleep practices.

Rationale: Throughout hospitalization and postdischarge, continued STS contact is a safe and important approach to support thermoregulation for healthy preterm neonates born after 34 weeks of gestation (AAP & ACOG, 2017: VI; AWHONN, 2021: VI). Rooming-in allows for unrestricted STS contact and promotes a greater opportunity for feeding, response to infant cues, and parent–infant interaction (AAP & ACOG, 2017: VI; Moore et al., 2016: I), as well as the opportunity to identify ways to avoid hypothermia or hyperthermia. Modeling safe sleep practices in the hospital may reduce the risk of sleep-related deaths related to overheating (Moon et al., 2022: VI).

Recommendation (T13): Minimize interruptions in STS contact.

a. **Be flexible about routine care of the neonate.**
b. **Continue close observation of the parent and LPI during STS sessions.**

Rationale: The mother's body heat can adjust to the newborn's temperature to support thermoregulation during STS contact (Neczypor & Holley, 2017: VI). Nurses can partner with parents to identify evidence-based strategies to reduce interruptions in STS contact and support thermoregulation (AWHONN, 2021: VI; Lilliesköld et al., 2022: VI).

Recommendation (T14): Delay bathing until thermal and cardiorespiratory stability has occurred, unless medically indicated.

a. **Consider postponing bathing the LPI until 12 to 24 hours after birth.**
b. **Consider using immersion and swaddle bathing techniques.**

Rationale: Delaying or omitting the bath (unless it is medically indicated) may reduce cold stress and maintain thermoregulation (AWHONN, 2019: VI; Wight et al., 2021: VI). The CDC provides recommendations on medical indications for earlier bathing. LPIs may take 12 to 24 hours to reach thermal stability. Complications related to cold stress increase the LPI's risk of mortality and morbidity as compared with term neonates; therefore, delayed bathing is recommended (AWHONN, 2019: VI; Weiner & Zaichkin, 2021: VI; World Health Organization, 2015: VI). A retrospective cohort study of 1,225 healthy newborns at 34 or more weeks of gestation found that delayed bathing until 24 hours of age was associated with increased exclusive breastfeeding at discharge and decreased hypothermia and hypoglycemia (Warren et al., 2020: IV).

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Hypoglycemia

Hypoglycemia is the most common metabolic problem in newborns and may lead to persistent brain injury. Newborns with identified risk factors should be monitored for hypoglycemia, because they are often asymptomatic. Clinically significant neonatal hypoglycemia reflects an imbalance between supply and use of glucose and alternative fuels. Blood glucose concentrations as low as 25 mg/dL are common in healthy asymptomatic newborns by 1 to 2 hours after birth; these levels are usually transient and may be part of normal adaptation to postnatal life (Adamkin & Pollin, 2016). Values for plasma glucose concentrations steadily increase over the first 48 hours of life and return to values near 70 mg/dL (Adamkin & Pollin, 2016). There is no current consensus on the treatment threshold for glucose values in newborns, including LPIs (Adamkin & Polin, 2016; Roeper et al., 2023).

Note: For the purposes of this Guideline, we refer to the AAP hypoglycemia recommendations (see Appendix HG-A). If newer resources become available, they should be incorporated into organizational protocols.

Recommendation (HG1): Review the prenatal/intrapartum history for conditions that increase the risk of hypoglycemia in the LPI (see Table HG-1).

TABLE HG-1 RISK FACTORS FOR NEONATAL HYPOGLYCEMIA

Conditions of the Gestational Parent	Conditions of the LPI

• Diabetes mellitus
• Hypertensive disorders
• Obesity
• Multiple-gestation pregnancy
• Medications
  • Tocolytics
  • Intravenous glucose administered late antepartum/intrapartum
  • Beta blockers
  • Antenatal corticosteroids
• Difficult or prolonged delivery
	• IUGR
	• SGA
	• LGA
	• 5-minute Apgar score less than 7
	• Hypothermia or temperature instability
	• Sepsis
	• Respiratory distress
	• Polycythemia
	• Perinatal stress
	• Congenital syndromes with hypoglycemia

Rationale: The incidence of neonatal morbidity, including hypoglycemia, increases with decreasing gestational age and exposure to maternal medical conditions in utero (Bulut et al., 2016: VI; Williams & Pugh, 2018: VI). The incidence of hypoglycemia in at-risk neonates, including LPIs, is estimated to be significantly higher than in term neonates (Bonnevier et al., 2018: IV; Cummings et al., 2022: IV; Stark et al., 2020: IV). Therefore, strategies to identify maternal and newborn conditions that impact blood glucose levels and strategies to identify and respond to hypoglycemia are important to prevent short- and long-term morbidity in LPIs.

MATERNAL CONDITIONS

Maternal conditions are associated with either decreased or inadequate production of glucose or increased utilization of glucose, which impacts fetal pancreatic response to glucose needs (Jonas et al., 2014; IV; Magadla et al., 2019; IV; Thornton et al., 2015: IV; Wight et al., 2021: VI). When exposed to maternal hyperglycemia, the fetal pancreas responds by excreting higher levels of insulin (Blackburn, 2018: VII). Fetal exposure to increased maternal glucose is suddenly stopped once the cord is separated at birth. It often takes several hours before the neonatal pancreas decreases its endogenous insulin excretion, which increases the risk of hypoglycemia during and after the period of transition (Blackburn, 2018; VII; Magadla et al., 2019: IV; van Kempen et al., 2020: II; Wight et al., 2021: VI). People with a high body mass index have increased glucose utilization during pregnancy, which may lead to in utero hyperinsulinemia, resulting in prolonged neonatal hypoglycemia after birth (Kureshi et al., 2022: IV). Prepregnancy type I diabetes and gestational diabetes are associated with increased risk of late preterm birth. Maternal hemoglobin A1c levels higher than 6.5 mg/dL, especially in the third trimester of pregnancy, have been associated with adverse outcomes and an increased incidence of hypoglycemia in the LPI population (Magadla et al., 2019: IV; Xu et al., 2020: IV).

Some medications taken during pregnancy may increase the risk of neonatal hypoglycemia.

Neonatal hypoglycemia occurred in 4.3% of offspring exposed to in utero beta blockers compared with 1.2% of offspring who were not exposed (Bateman et al., 2016: IV). Although data are conflicting and definitions of hypoglycemia vary, some researchers found that the administration of antenatal corticosteroids in the LPI population is associated with an increased incidence of hypoglycemia (Badreldin et al., 2020: IV; Gulersen et al., 2021: IV; Gyamfi-Bannerman et al., 2023: II; Ustun et al., 2021: IV). A retrospective study of 500 LPIs who were exposed to in utero corticosteroids found that those in the immature group (34 0/7–35 6/7 weeks) had improved respiratory outcomes with no hypoglycemia, whereas those in the mature age range (36 0/7–36 6/7 weeks) had no change in respiratory outcomes but did have increased rates of hypoglycemia (Janssen et al., 2021: VI).

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NEONATAL CONDITIONS

Complications related to cold stress increase the risk of LPI mortality and morbidity (George & Holmquist, 2019: VI; Weiner & Zaichkin, 2021: VI). The increased stress on the fetus during a prolonged or difficult birth may impact glucose utilization during labor and birth (Adamkin, 2017: VII). The increased risk for cold stress predisposes the LPI to difficulties with respiratory transition and exacerbates hypoglycemia and compensatory mechanisms, which can lead to alterations that are difficult to reverse (Brand & Shippey, 2021: VI). Hypoglycemia may also result from sepsis, hypothermia, respiratory distress, polycythemia, or hypopituitarism (Brand & Shippey, 2021: VI). These conditions can rapidly deplete glycogen reserves in the LPI.

LPIs demonstrate IUGR more often than preterm neonates born at gestational ages less than 34 weeks (Kreko et al., 2019: IV). Because of a lack of sufficient glycogen or adipose stores (Blackburn, 2018: VII), LPIs who have IUGR or are SGA have an increased incidence of hypoglycemia when compared with LPIs who are AGA (Kreko et al., 2019: IV; Mallick et al., 2019: IV). All newborns who are LGA, especially those born to people with diabetes during pregnancy, are at increased risk for hypoglycemia because of neonatal transient hyperinsulinemia after birth (Blackburn, 2018: VII).

Recommendation (HG2): Collaborate to ensure organizational protocols for the assessment and management of neonatal hypoglycemia are developed and implemented.

Rationale: Many facilities review and use guidelines from different national organizations to develop standardized screening and management protocols for hypoglycemia in the LPI. Threshold glucose ranges for diagnosis and intervention vary according to gestational age, postnatal age, risk factors, and facility protocol. Data are lacking on specific blood glucose values that define hypoglycemia and significant hypoglycemia in the first 48 hours of life (Adamkin, 2017: VII; Wight et al., 2021: VI). The concern for neurologic morbidity associated with persistent low levels of glucose in newborns, specifically those with risk factors, has led to the establishment of national guidelines (Adamkin & Committee on the Fetus and Newborn, 2011; VI; Thornton et al., 2015: VI; Wight et al., 2021: VI), which may have varying recommendations. However, there is consensus that the transitional form of hypoglycemia usually resolves within 48 hours after birth, and hypoglycemia persisting beyond that time may indicate a pathologic condition (Adamkin & Committee on the Fetus and Newborn, 2011; VI; Thompson-Branch & Havranek, 2017; VI; Thornton et al., 2015: VI). The threshold glucose ranges cited in this Guideline are based on review of the current literature and recommendations from national organizations (Adamkin & Committee on the Fetus and Newborn, 2011; VI; Thornton et al., 2015: VI).

Recommendation (HG3): Monitor the LPI closely for hypoglycemia during the transitional period using point-of-care glucose screening by heel or venous sampling.

- **Confirm low point-of-care test results with plasma glucose levels.**

Note: Glucose screening may occur while the LPI is in STS contact.

Rationale: LPIs have decreased glycogen reserves, decreased activity of gluconeogenic enzymes, depressed hormonal response, and slower postnatal glucose increase after reaching the nadir (Blackburn, 2018: VII). These physiologic challenges can ultimately result in hypoglycemia; therefore, assessment of glucose levels during the transitional period is critical (Thornton et al., 2015: VI; Wight et al., 2021: VI). Glucose levels can be assessed via whole blood, plasma, or serum. Although a drawn blood sample is generally more accurate than a rapid test, the rapid test results allow clinicians to initiate immediate treatment while waiting for the plasma glucose values (Thompson-Branch & Havranek, 2017: VI; Wight et al., 2021: VI). Both nonenzymatic and enzymatic analyzers are available for point-of-care testing. Bedside reagent test-strip glucose analyzers (glucometers) are convenient and provide rapid results, which facilitate prompt treatment, if necessary; however, the difference between the actual blood glucose level when compared with the rapid glucose results using test strips may be as high as 20 mg/dL, and results are the most unreliable for low glucose ranges (Thompson-Branch & Havranek, 2017: VI; Wight et al., 2021: VI). Therefore, a diagnosis of hypoglycemia should not be made without confirming glucose plasma levels (Adamkin, 2017; VII; Thornton et al., 2015: VI; Wight et al., 2021: VI).

Recommendation (HG4): Monitor for symptoms of hypoglycemia, which may include but are not limited to the following:

a. **Early signs: sweating, pallor, temperature instability, irritability, hunger, tremulousness, tachycardia, and vomiting**
b. **Late signs: apnea, hypotonia, seizure, and coma**

Rationale: Clinical signs may be present at varying blood glucose concentrations, or the neonate may be asymptomatic despite dangerously low glucose values. Because hypoglycemia has a nonspecific and extremely variable presentation, glucose concentrations should be evaluated in the context of the newborn's condition (Adamkin & Committee on the Fetus and Newborn, 2011: VI; Blackburn, 2018: VII; Wight et al., 2021: VI). Newborns who display signs and symptoms of hypoglycemia are more likely to experience a neuronal injury (Adamkin, 2017; VII; Thornton et al., 2015: VI). Therefore, plasma or blood glucose concentrations should be measured immediately in any LPI who manifests clinical signs of low blood glucose (Adamkin & Committee on the Fetus and Newborn, 2011; VI; Thompson-Branch & Havranek, 2017: VI; Wight et al., 2021: IV).

Recommendation (HG5): Individualize glucose screenings based on risks and symptoms in LPIs (see Table HG-1 and Appendix HG-A).

Rationale: Blood glucose thresholds for screening and treatment of the asymptomatic at-risk newborn for hypoglycemia remain controversial. There is a lack of data demonstrating poor outcomes during this normal postnatal period of establishing physiologic glucose homeostasis (Adamkin, 2015: VI). However, evidence shows that undertreatment as well as overtreatment has the potential to adversely impact neurologic outcomes (McKinlay et al., 2015: IV). Although a single low glucose level may not equate to neuronal injury, persistent low glucose levels are a concern (McKinlay et al., 2015; IV; Thornton et al., 2015: VI). Ideally, the plasma glucose concentration at which intervention is indicated should be tailored to the clinical situation and the characteristics of the newborn (Adamkin, 2015: VI). Screening of the asymptomatic at-risk infant should be performed within the first hours of birth and continued through multiple feed–fast cycles (Thornton et al., 2015: VI; Wight et al., 2021: VI).

Recommendation (HG6): Provide early, frequent feedings on demand, allowing no more than 2 to 3 hours between feedings.

a. **If the breastfed newborn requires supplementation, human milk or donor human milk should be provided whenever possible.**
b. **Continue to screen glucose levels before feeding until the newborn is stable for at least two consecutive feedings.**

Rationale: Compared with adults, neonates have two to three times the glucose utilization rate; therefore, frequent feedings are essential to provide adequate circulating glucose (Thornton et al., 2015: VI; Wight et al., 2021: VI). The LPI is at further risk for low glucose levels because the plasma glucose concentration decreases postnatally to values less than those of a term neonate, and the compensatory mechanisms responsible for protecting the brain from injury are not yet mature (Wight et al., 2021: VI). Mild to moderate hypoglycemia may be managed with frequent feedings (Wight et al., 2021: VI). Monitoring plasma glucose levels after feeding helps to ensure that a safe, steady-state glucose concentration has been achieved (Harris et al., 2012: IV). Glucose values should be serially monitored and the newborn observed according to the degree of hypoglycemia, the trend over time, responses to feedings, and presentation of symptoms (Adamkin & Committee on the Fetus and Newborn, 2011: VI; Wight et al., 2021: VI).

Feedings may not be well established in the first 24 hours of life, which may lead to low glucose concentrations, especially in the LPI. A cohort study of 514 newborns at risk for hypoglycemia, including LPIs, demonstrated that one third of the infants did not have a first episode of hypoglycemia until after the first three feedings; 6% of the infants had a first episode of hypoglycemia after 24 hours of age (Harris et al., 2012: IV). The LPI may need closer observation than the healthy term newborn. It is postulated that breastfed newborns tend to exhibit and tolerate lower plasma glucose values than formula-fed newborns (Adamkin & Committee on the Fetus and Newborn, 2011: VI; Wight et al., 2021: VI).

See "Feeding Challenges" in this Guideline for more information.

Recommendation (HG7): Consider the use of oral dextrose gel to improve blood glucose levels in newborns less than 48 hours of age.

Rationale: Glucose gel has been demonstrated to be effective even in exclusively breastfed newborns. For some LPIs, the use of glucose gel may help eliminate the need for intravenous fluids. A randomized, double-blind, placebo-controlled trial of neonates at 35 to 42 weeks of gestation found that dextrose gel given orally was effective as the first-line treatment for hypoglycemia when administered in the first 48 hours of life (Harris et al., 2013: II). Glucose gel may decrease the need for supplemental feedings and allow the LPI to breastfeed exclusively and maintain stable glucose levels (Bennett et al., 2016: VI).

Recommendation (HG8): For LPIs with persistent hypoglycemia, those with clinical signs of hypoglycemia, or those who feed poorly or do not tolerate feedings, intravenous glucose may be indicated. A suggested protocol includes the following (see Appendix HG-A):

a. **An intravenous bolus of 2 mL/kg of 10% dextrose in water (D10W) should be given immediately and an intravenous D10W infusion initiated at a rate of 5 to 8 mg/kg/minute (80–100 mL/kg/day), depending on hours of age and facility protocol.**
b. **A repeat plasma glucose level should be obtained within 30 minutes of completion of the D10W bolus.**
c. **The plasma glucose value should be rechecked every 1 to 2 hours until a safe, steady-state glucose concentration has been achieved.**
d. **Plasma glucose levels should be maintained between 40 and 50 mg/dL (2.2–2.8 mmol/L) in those LPIs receiving intravenous glucose therapy.**

Note: Allow LPIs on continuous intravenous glucose therapy to continue to breastfeed, unless medically unstable.

Rationale: For newborns with clinical signs of hypoglycemia or those who do not respond initially to oral feedings, start intravenous glucose at an initial rate of 4 to 6 mg/kg/minute, with the target blood glucose concentration maintained above the hypoglycemic threshold. If hypoglycemia persists, the AAP recommends administering intravenous glucose solution at a rate of 5 to 8 mg/kg/minute (80–100 mL/kg/day; Adamkin & Committee on the Fetus and Newborn, 2011: VI). Ongoing vigilance is essential, as adverse effects of hypoglycemia can occur at any point during hospitalization and vary with the newborn's clinical condition. Although a level of 45 mg/dL (2.6 mmol/L) is cited as the threshold for intervention (Adamkin & Committee on the Fetus and Newborn, 2011: VI), some advocate a higher level of 55 to 70 mg/dL (3.05–3.80 mmol/L) for euglycemia, especially after the first 4 hours of life (Adamkin, 2017; VII; Adamkin & Polin, 2016: VI). Encouraging breastfeeding during intravenous

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glucose administration or returning the neonate to the breast as soon as possible is important in maintaining adequate maternal breast milk supply and neonatal glucose levels (Wight et al., 2021: VI).

Recommendation (HG9): For LPIs with continuing hypoglycemia, consider the need for additional diagnostic testing and possible transfer to a higher-acuity unit or a high-risk facility.

Rationale: Hypoglycemia may result from another etiology, such as sepsis, hypothermia, respiratory distress, polycythemia, or hypopituitarism. Thus, diagnostic testing may be needed, as well as an increased level of nursing surveillance and access to a broad range of therapies, such as diazoxide, glucagon, corticosteroids, or somatostatin, to attain and maintain euglycemia (Kamath-Rayne et al., 2016: VI). The most common cause of persistent hypoglycemia in the neonatal period is hyperinsulinemic hypoglycemia (Adamkin & Committee on the Fetus and Newborn, 2011: VI).

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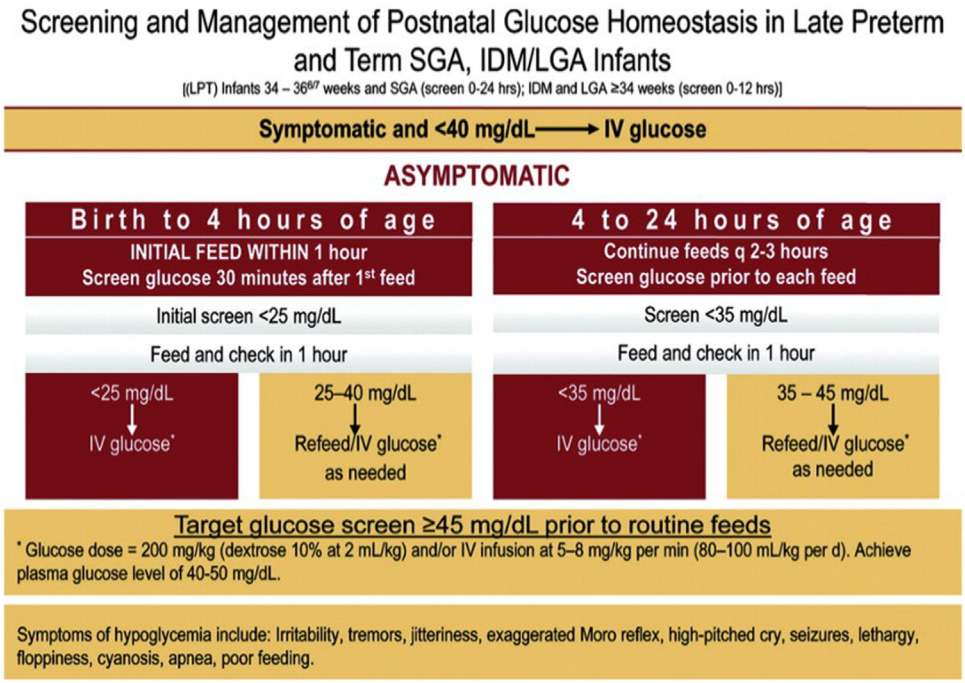
APPENDIX HG-A



Note. IDM = infant of diabetic mother; IV = intravenous; LGA = large for gestational age; LPT = late preterm; SGA = small for gestational age. From "Postnatal Glucose Homeostasis in Late-Preterm and Term Infants," by D. H. Adamkin and Committee on Fetus and Newborn, March 2011, *Pediatrics, 127*(3), pp. 575–579 (https://doi.org/10.1542/peds.2010-3851). Used with permission.

Feeding Challenges

LPIs may have many feeding challenges related to immaturity. However, it is important to identify any additional risk factors that impact breastfeeding success, including social determinants of health, such as low socioeconomic status and lower educational levels, and parents without a partner or additional support (Carpay et al., 2021). Health care professionals and those who create policies should be aware of these social determinants and design individualized interventions to improve breastfeeding success (Carpay et al., 2021). Hospital programs should be specific to support successful feeding for LPIs and include nursing and family education, feeding support, and care guidelines. These programs can reduce readmission by 80% (Ponto & Kowal, 2020), increase frequency of feeding (Lober et al., 2020), and increase exclusive breastfeeding (Estalella et al., 2020).

Recommendation (FC1): Recognize that LPIs are at increased risk for ineffective breast- or chestfeeding.

Rationale: LPIs, even when considered stable, may have difficulty achieving consistent effective breastfeeding because of insufficient milk transfer. LPIs are often easily fatigued, may be hypotonic, and may have trouble achieving and maintaining a deep latch because of poor suck coordination and inadequate suck pressure (Lapillonne et al., 2019: VI).

Recommendation (FC2): Observe and validate the parent's knowledge about common feeding behaviors of LPIs, such as the following:

a. **Patterns of sucking, including coordination of sucking, swallowing, and breathing**
b. **Need to wake before feedings**
c. **Need for frequent feedings**
d. **Breastfeeding positions**
e. **Need for frequent STS contact**
f. **Importance of monitoring milk intake**

Rationale: It is important to help parents understand their newborn's feeding patterns and behaviors and to provide individualized education specific to the unique needs of the parent–newborn couplet. For example, teaching should include that the LPI is easily fatigued, may be hypotonic, may have poor head control, and may have difficulties establishing an effective latch. Providing parents with education and support during the initial feedings may improve breastfeeding success (Carpay et al., 2021: V). Compared with term neonates, LPIs are at higher risk for feeding problems, poor growth, and dehydration, resulting in increased incidence of readmissions and visits to emergency departments; therefore, oral intake, weight gain, and milk supply monitoring are priorities (Karnati et al., 2020: V).

See "Parent Readiness and Support" in this Guideline for more information.

Recommendation (FC3): Assess readiness to feed before initiating oral feedings using the following behavioral feeding cues:

a. **Rooting**
b. **Hand-to-mouth movements**
c. **Sucking movements or sounds**
d. **Opening of mouth in response to tactile stimulation**
e. **Transition between behavioral states from sleep to drowsy and quietly alert**

Rationale: Sucking and rooting reflexes are needed for oral intake and synchronization of suck–swallow; development of these reflexes is usually complete by 36 to 38 weeks of gestation (Blackburn, 2018: VII). LPIs who demonstrate behavioral feeding cues that show readiness to feed may have better coordination and more success in feedings. Preterm neonates have a high physiologic drive to sleep, with waking periods lengthening with age (Georgoulas et al., 2021: IV). Successful feeding may be more likely to occur during the newborn's normal wake cycles.

Recommendation (FC4): Evaluate the LPI's ability to coordinate sucking, swallowing, and breathing, including behaviors demonstrating success or stress.

Rationale: Because of their functional immaturity, LPIs have immature suck–swallow–breathe coordination and oral–motor skills, fewer awake–alert periods, and poorer postural control than full-term infants (Karnati et al., 2020: V), which may lead to stress during feeding. The high energy requirement of the LPI to eat may lead to poor growth (Karnati et al., 2020: V). Behaviors demonstrating success include smooth, regular respirations and hand activity near the face with good posture. Behaviors demonstrating stress include increased respiratory rate, coughing, and choking.

Recommendation (FC5): Facilitate early and frequent feedings. The initial feeding should be within the first hour of birth.

a. **Encourage the parent to express colostrum in addition to feedings/feeding attempts within the first hour and at approximately 2- to 3-hour intervals.**
b. **The LPI should feed at least every 3 hours during the first few days.**

Note: Support the parent to begin expressing milk if supplementation is indicated or the parent and newborn are separated, using hand expression, an electronic pump, or both.

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Rationale: Early milk expression assists with lactogenesis. Delayed lactogenesis compounds breastfeeding difficulties (Verklan, 2021: VI). Ensuring adequate milk production will help lead to exclusive breastfeeding (Jonsdottir et al., 2020: IV) or an exclusive human milk diet. If the parent and newborn are separated or feeding is ineffective, the postpartum patient should hand-express colostrum within the first hour after birth and at approximately 3-hour intervals; these interventions will assist with the establishment of milk supply (Boies & Vaucher, 2016: VI). Some researchers have found hand expression to be more effective than the use of a breast pump in milk expression (Boies & Vaucher, 2016: VI). If pumping is initiated within 1 hour of birth (compared with 6 hours after birth), lactogenesis II will be achieved earlier, and there will be a significantly increased milk supply at 3 weeks following birth (Spatz et al., 2015: VI). If the LPI is not aroused to feed by 4 hours after the last feeding, it is important to wake the LPI up to feed (AAP & ACOG, 2017: VI).

Recommendation (FC6): Assess effectiveness of breastfeeding and chestfeeding effort, including milk transfer and oral–motor function, using a validated breastfeeding/chestfeeding assessment tool, such as the following:

a. Preterm Infant Breastfeeding Behavior Scale
b. LATCH score
c. Infant Breastfeeding Assessment Tool (IBFAT)
d. Mother/Baby Assessment Tool

Rationale: For breastfeeding LPIs, evaluation of feeding by a lactation consultant or other health care professional with expertise in lactation management should be performed as soon as possible after birth (Boies & Vaucher, 2016: VI). Because of their immaturity, LPIs are less alert, have less endurance, and have increased difficulties with the tasks of latching, sucking, swallowing, and breathing that impact milk transfer (Boise & Vaucher, 2016: VI). Breastfeeding should be assessed and documented at least twice daily by two different health care professionals, using a standardized tool (e.g., Preterm Infant Breastfeeding Behavior Scale, LATCH score, Infant Breastfeeding Assessment Tool, or Mother/Baby Assessment Tool; Boies & Vaucher, 2016: VI; Lober et al., 2020: IV). The Preterm Infant Breastfeeding Behavior Scale has been validated for use with the LPI population (Lober et al., 2020: IV).

Recommendation (FC7): Assess and document feeding effectiveness at least twice in 24 hours.

a. Feeding assessments should be done by two different professionals trained in breastfeeding/chestfeeding and lactation management, whenever possible.
b. Monitor the LPI for physiologic stability during early feedings.

Rationale: Physiologic instability may lead to the inability to maintain successful feedings. When compared with full-term newborns, LPIs are at greater risk for medical problems, including difficulty maintaining body temperature (Boise & Vaucher, 2016: VI; Karnati et al., 2020: V); are more vulnerable to infection; have more respiratory instability (Karnati et al., 2020: V); and are at risk for hypoglycemia, all of which may lead to unsuccessful breastfeeding (Boise & Vaucher, 2016: VI).

Recommendation (FC8): Encourage early and frequent STS contact.

Rationale: STS contact is a major contributor to exclusive breastfeeding (Cartwright et al., 2017: V). Researchers compared breastfeeding outcomes in a cohort study of 844 mothers and their LPIs when using kangaroo mother care (KMC). Of those using KMC ($n = 627$), 54.6% were exclusively breast milk feeding at discharge and 57.3% at follow-up. Mothers who did not choose to use KMC ($n = 217$) had lower breast milk feeding at discharge (34.6%) and at follow-up (33.2%; Zhang et al., 2020: IV). Researchers suggest that KMC care may be an effective strategy to increase breastfeeding rates.

See "Thermoregulation" in this Guideline for more information.

Recommendation (FC9): Provide supplemental feeding after breastfeeding with appropriate volumes, if medically indicated. Medical indications include but are not limited to the following:

- **Excessive weight loss**
- **Poor feeding**
- **Hyperbilirubinemia**
- **Parent–newborn separation**

Note: Supplemental feeding volumes may be 5 to 10 mL per feeding on Day 1 and 10 to 30 mL per feeding thereafter (Boise & Vaucher, 2016: VI).

Rationale: Supplementation with small volumes will prevent dehydration and excessive weight loss. Supplementation should only be used until breast- or chestfeeding is well established, unless the parent chooses to routinely supplement with human milk. The Academy of Breastfeeding Medicine provides guidance on specific volumes based on the age of the LPI in days (Boies & Vaucher, 2016: VI). Encouraging supplementation in alignment with these recommendations will help support newborn growth and development (Boies & Vaucher, 2016: VI). Oversupplementation may lead to satiety, decrease the infant's interest in breastfeeding, and diminish milk supply (AAP & ACOG, 2017: VI). Weight loss of 3% or more from birth weight in the first 24 hours or 7% or more by Day 3 of life may indicate a need for further monitoring (Boies & Vaucher, 2016: VI).

a. Supplemental feedings should be offered in the following order:

- **Expressed human milk**
- **Pasteurized donor human milk (PDHM)**
- **Formula**

Note: Consider informal milk sharing if expressed human milk or PDHM is not available.

Rationale: LPIs have challenges receiving adequate breast milk and may require supplementation. Some of these challenges include immature gastrointestinal function, immature sucking movements, and low intake that can result in excessive weight loss, low metabolic reserve, poor feeding, or significant hyperbilirubinemia (Asadi et al., 2019: VI). The goals of providing good nutrition for the LPI are to achieve a postnatal growth rate similar to intrauterine growth rate at the same gestational age and to ultimately achieve developmental outcomes similar to those of term infants. Human milk provides the optimal nutrition to help achieve these goals (Asadi et al., 2019: VI). A retrospective chart review of LPIs ($N = 183$) admitted to the mother–baby unit found that exclusive human milk feeding was associated with a shorter length of stay than formula-feeding. Exclusively formula-fed infants had a length of stay 23% longer than exclusively breastfed LPIs, and breastfed LPIs who had any formula supplementation during their hospital stay were 16% less likely to continue breastfeeding than breastfed LPIs who received human milk supplementation (Mannel & Peck, 2018: VI).

A cohort study of neonates at risk for hypoglycemia ($N = 104$), including LPIs, found that adapting a unit-based hypoglycemia algorithm to replace the use of glucose gel with PDHM resulted in decreased NICU admissions and an increase in exclusive breastfeeding rates at discharge (Ponnapakkam et al., 2021: III). Additionally, at-risk neonates supplemented with PDHM had a greater increase in blood glucose when compared with those supplemented with maternal breast milk (Ponnapakkam et al., 2021: III). Ideally, LPIs should be offered expressed human milk or PDHM if more volume is needed. If PDHM is not available, informal milk sharing may be considered after a discussion of risks and benefits with the parents (AWHONN, 2021: VI). Formula may be necessary if expressed milk and donor milk are not available.

b. Supplemental feeding methods include the following:

- **Gavage feeding**
- **Cup feeding**
- **Syringe feeding**
- **Spoon feeding**
- **Supplementing system at the breast**
- **Bottle feedings**

Rationale: Supplemental methods of feeding may be medically indicated for the LPI. Decreased muscle tone and oral–motor control combined with lower physiologic stability in the LPI may lead to decreased arousal and fatigue during feeding (Boise & Vaucher, 2016: VI; Karnati et al., 2020: V). Supplementation should be based only on the neonate's specific risks or problems with nutrition or growth, and neonates should be weaned from supplements as soon as their condition permits (Harris et al., 2012: IV). An integrative review of 12 studies seeking to analyze the literature on cup feeding found that preterm breastfed infants who were cup-fed were more likely to be exclusively breastfed at hospital discharge when compared with those who were bottle-fed (Penny et al., 2018: I). An additional study found that finger-fed preterm infants demonstrated better comfort and shorter transition times to breastfeeding than syringe-fed preterm infants (Buldur et al., 2020: II).

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Hyperbilirubinemia

LPIs have a greater prevalence, severity, and duration of neonatal hyperbilirubinemia than term infants (Watchko & Maisels, 2020). The risk for developing significant hyperbilirubinemia increases with each additional week below 40 weeks of gestation (Kemper et al., 2022). The threshold for hyperbilirubinemia requiring treatment to prevent kernicterus differs by gestational age, hours of life, and risk factors. Preterm neonates are more likely to develop physiologic hyperbilirubinemia than term neonates because of delayed feeding, initial low caloric intake, slower intestinal motility, and lower serum albumin levels that may limit extracellular transport of bilirubin (Blackburn, 2018). LPIs have more than a fivefold increased risk for neonatal hyperbilirubinemia (Watchko & Maisels, 2020).

Recommendation (HB1): Recognize that the LPI is at increased risk for developing hyperbilirubinemia and is more susceptible to severe hyperbilirubinemia and kernicterus, with those born at lower gestational ages having the highest risk.

- **Identify risk factors for severe hyperbilirubinemia and those leading to neurotoxicity (see Table HB-1).**

Rationale: Many factors may increase the risk for severe hyperbilirubinemia in LPIs. Several risk factors have been identified for severe hyperbilirubinemia for newborns born at or before 35 weeks of gestation (Kemper et al., 2022: VI). Bilirubin rate of rise and peak can vary by genetic ancestry (Blackburn, 2018: VII); therefore, family history of a sibling who had phototherapy may be a risk factor for hyperbilirubinemia. Glucose-6-phosphate dehydrogenase (G6PD) deficiency is one of the leading causes of hyperbilirubinemia leading to kernicterus. G6PD is a genetic disorder that decreases protection against oxidative stress (Kemper et al., 2022: VI). LPIs diagnosed with sepsis may have hyperbilirubinemia because of the increase of bilirubin concentration that results from hemolysis or by impaired conjugation, which causes decreased excretion of bilirubin (Fanaroff & Fanaroff, 2020: VI). The presence of risk factors for bilirubin neurotoxicity lowers the threshold for treatment with phototherapy and the level at which care should be escalated. The presence of these risk factors increases the risk for developing significant hyperbilirubinemia and bilirubin neurotoxicity (Kemper et al., 2022: VI).

Recommendation (HB2): Monitor for risk factors of hyperbilirubinemia (see Table HB-1).

Rationale: LPIs and preterm infants have an increased risk of developing acute bilirubin encephalopathy and kernicterus (Blackburn, 2018: VII; Stewart et al., 2019: VI). The AAP's "Clinical Practice Guideline Revision: Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation" indicates that gestational age of less than 38 weeks increases the risk of hyperbilirubinemia neurotoxicity, with the risk increasing even more with the increasing degree of prematurity (Kemper et al., 2022: VI).

Clinical manifestations of acute bilirubin encephalopathy may be more subtle in the LPI compared with the term neonate and can consequently lead to kernicterus and permanent neurologic damage (Stewart et al., 2019: VI). Exposure to bilirubin, even moderate concentrations, may result in subtle but permanent neurologic dysfunction (Stewart et al., 2019: VI), which may be quantified in severity using a numeric scoring system of bilirubin-induced neurologic dysfunction (BIND; Hameed & Hussein, 2021: IV). A common result of BIND in the LPI is auditory neuropathy spectrum disorder (Stewart et al., 2019: VI). Auditory neuropathy spectrum disorder occurs when there is damage to the auditory nerve, the pathway between the inner ear's cochlea and the brain, and is the most common condition associated with acute bilirubin encephalopathy (Stewart et al., 2019: VI).

TABLE HB-1 RISK FACTORS FOR NEONATAL HYPERBILIRUBINEMIA

Risks for Significant Hyperbilirubinemia	Risks for Neurotoxicity
• Lower gestational age • Jaundice in the first 24 hours after birth • Predischarge transcutaneous bilirubin concentration close to the phototherapy threshold • Hemolysis from any cause • Phototherapy prior to discharge • A parent or sibling requiring phototherapy or an exchange transfusion • A family history or genetic ancestry suggestive of inherited red blood cell disorders, including G6PD deficiency • Exclusively breastfed with suboptimal intake • A scalp hematoma or significant bruising • Down syndrome • Macrosomic newborn of a diabetic parent	• Gestational age < 38 weeks; the risk increases with the degree of prematurity • Albumin < 3.0 g/dL • Isoimmune hemolytic disease, G6PD deficiency, or other hemolytic conditions • Sepsis • Significant clinical instability in the previous 24 hours

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Recommendation (HB3): Assess the presence of jaundice in the first 24 hours of life and initiate immediate screening of transcutaneous bilirubin (TcB) or total serum bilirubin (TSB) if visible jaundice is present.

- **Continue to visually assess LPIs for jaundice during routine assessments.**

Rationale: The presence of jaundice in the first 24 hours is often attributed to a hemolytic process, which places the LPI at higher risk for kernicterus. Therefore, prompt identification and treatment are imperative (Kemper et al., 2022: VI). Visual assessment of jaundice alone, particularly in the LPI, is poorly correlated with bilirubin levels and, if solely relied upon, can result in a delay in treatment (Kemper et al., 2022: VI). Periodic assessments for jaundice can be a supplementary tool for early identification of hyperbilirubinemia that can cause significant hemolysis (Kemper et al., 2022: VI).

TcB can be used as an initial screening tool for hyperbilirubinemia. TcB measurements estimate the bilirubin level using reflectance photometry or transcutaneous colorimetry (Kemper et al., 2022: VI). TcB instruments are a valid and reliable screening tool to identify newborns who require TSB measurement and reduce blood draws (Kemper et al., 2022: VI; Okwundu et al., 2017: I).

Recommendation (HB4): Plot TcB or TSB levels on an hour-specific bilirubin nomogram to identify the neonate's risk of developing severe hyperbilirubinemia (see Appendices HB-A and HB-B).

- **If the TcB exceeds or is within 3 mg/dL of the phototherapy treatment threshold, or if the TcB is 15 mg/dL or more, confirm with a TSB.**

Rationale: The level of hyperbilirubinemia requiring treatment to prevent kernicterus differs by gestational age, hours of life, and risk factors (Kemper et al., 2022: VI). TcB and TSB levels generally have a good correlation (within 3 mg/dL) in newborns with TSB concentrations lower than 15 mg/dL; however, these levels can vary with melanin concentration and the measurement instrument used (Kemper et al., 2022: VI). Almost all studies designed to determine the need for phototherapy treatment are based on TSB levels measured in the hospital laboratory (Kemper et al., 2022: VI). The difference between the bilirubin concentration and the phototherapy threshold at the time of measurement can be used to determine the interval between discharge and follow-up and the need for additional TSB or TcB assessment (Kemper et al., 2022: VI). A rapid rate of increase in TSB or TcB levels of more than 0.3 mg/dL per hour in the first 24 hours of life or more than 0.2 mg/dL per hour thereafter may be caused by hemolysis, and further evaluation is indicated (Kemper et al., 2022: VI). If the TcB level is within 3 mg/dL of the phototherapy treatment threshold or is 15 mg/dL or more, there is a high risk for severe hyperbilirubinemia (Kemper et al., 2022: VI).

Recommendation (HB5): Ensure that intensive phototherapy is initiated when the neonate's TSB reaches the threshold for treatment based on the hour-specific nomograms, using a family-centered approach.

a. **Provide phototherapy using a narrow-spectrum light-emitting diode (LED) blue light with irradiance of at least 30 μW/cm^2/nm at a wavelength around 475 nm.**
b. **Ensure that there is adequate irradiance and maximum surface area exposed to the phototherapy light source.**

Rationale: The AAP guidelines address infants born at 35 weeks of gestation and older and are currently not applicable to those born between 34 weeks and 0 days and 34 weeks and 6 days of gestation (Kemper et al., 2022: VI). Phototherapy should be initiated at the TSB threshold determined by the newborn's gestational age, hyperbilirubinemia neurotoxicity risk factors, and age in hours (see Appendices HB-A and HB- B; Kemper et al., 2022: VI). The effectiveness of phototherapy depends on the light intensity, light spectrum, and surface area of the newborn's body exposed (Ansong-Assoku et al., 2022: VI; Bradshaw, 2021; VI; Fanaroff & Fanaroff, 2020: VI). Using a narrow-spectrum LED blue light with an irradiance of at least 30 μW/cm^2/nm at a wavelength of approximately 475 nm may help quickly lower the TSB and shorten the duration of treatment, thus decreasing the need to escalate care (AAP & ACOG, 2017: VI). Blue lights are most effective (Ebbesen et al., 2021: II); however, white lamps, high-intensity gallium nitride LEDs, and fiberoptic blankets may be effective alternatives (Bradshaw, 2021: VI). Administer phototherapy in a family-centered approach in a private room to allow the opportunity for bonding and breastfeeding (Kemper et al., 2022: VI).

Recommendation (HB6): Consider prophylactic phototherapy or earlier treatment thresholds for LPIs less than 35 weeks of gestation.

Rationale: There is an increased susceptibility to bilirubin toxicity as gestational age decreases. The bilirubin binding capacity of preterm infants increases by 0.93 mg/dL for each week of gestation, while at the same time albumin concentration increases by approximately 0.11 g/dL per week of gestation (AAP & ACOG, 2017: VI). Clinical judgment should be used when determining when to implement phototherapy in LPIs, specifically those with compounding risk factors. Prophylactic phototherapy may help lower serum bilirubin levels, which may decrease the risk of exchange transfusion or other complications (Fanaroff & Fanaroff, 2020: VI; Okwundu et al., 2012: I), such as hearing loss, motor dysfunction, and neurodevelopmental impairment (Blackburn, 2018: VII).

Recommendation (HB7): Obtain additional laboratory values for newborns with hyperbilirubinemia, as ordered by the neonatal care provider.

a. **Obtain a direct antiglobulin test to see whether maternal antibody screen is positive or unknown.**
b. **Obtain a direct antiglobulin test if the LPI has more than one TcB or TSB measurement available and the rate of rise suggests hemolysis.**

Rationale: Identification of maternal ABO blood group, Rh (D) type, and antibody screen will assist with identifying risk for potential isoimmune hemolytic disease of the fetus or newborn by identifying maternal anti-erythrocyte antibodies. Isoimmune hemolytic disease of the fetus or newborn increases the risk of hyperbilirubinemia. Assessment of newborns with maternal anti-erythrocyte antibodies will facilitate early management to prevent or minimize risk for hyperbilirubinemia (Kemper et al., 2022: VI). The newborn is at increased risk of subsequent hyperbilirubinemia if the rate of TcB or TSB rise is 3 mg/dL or more per hour in the first 24 hours of life or 2 mg/dL or more thereafter. This significant rate of rise is suggestive of hemolysis (Kemper et al., 2022: VI).

Recommendation (HB8): Encourage frequent feedings.

Rationale: Because of immaturity in the suck and swallow reflex, LPIs are at risk for inadequate or ineffective breastfeeding, which increases the risk of hyperbilirubinemia and hospital readmissions related to hyperbilirubinemia. Breastfeeding difficulties may result in inadequate caloric intake, increased bilirubin uptake in the intestine (enterohepatic circulation), and decreased excretion of meconium, which contains large amounts of unconjugated bilirubin that can be reabsorbed (Boies & Vaucher, 2016: VII). Supplementation may be needed after breastfeeding with small quantities of expressed human milk, donor human milk, or infant formula if human milk is not available. The choice in method of supplementation depends on parent preference, and the feeding plan should be revised using a shared decision-making model.

See "Feeding Challenges" in this Guideline for more information.

Recommendation (HB9): Repeat TSB assessment throughout the duration of phototherapy and within 12 to 24 hours after discontinuation of phototherapy.

Rationale: Repeat TSB measurements will help determine the newborn's response to the treatment. Ideally, repeat TSB measurement should be individualized but obtained no later than 12 hours after initiating phototherapy. A follow-up bilirubin test should be performed at least 12, preferably 24, hours after the discontinuation of phototherapy to rule out rebound hyperbilirubinemia. Except in specific circumstances, repeating the TSB between 12 and 24 hours should allow sufficient time for the bilirubin concentration to demonstrate whether rebound hyperbilirubinemia is present (Kemper et al., 2022: VI). Risk factors for rebound hyperbilirubinemia include gestational age less than 38 weeks, inadequate feeding and weight gain, and the other hyperbilirubinemia and hyperbilirubinemia neurotoxicity risk factors (Kemper et al., 2022: VI).

Recommendation (HB10): For LPIs being discharged before 1 week of life, obtain and evaluate bilirubin levels on the day of discharge using TcB or TSB levels.

Rationale: Predischarge bilirubin screening can be used to predict the development of hyperbilirubinemia requiring treatment. All newborns should be evaluated for hyperbilirubinemia between 24 and 48 hours after birth and on the day of discharge by measuring the TcB or TSB levels (Kemper et al., 2022: VI; Verklan, 2021: VI). LPIs discharged after 1 week of life may not need additional screening for hyperbilirubinemia.

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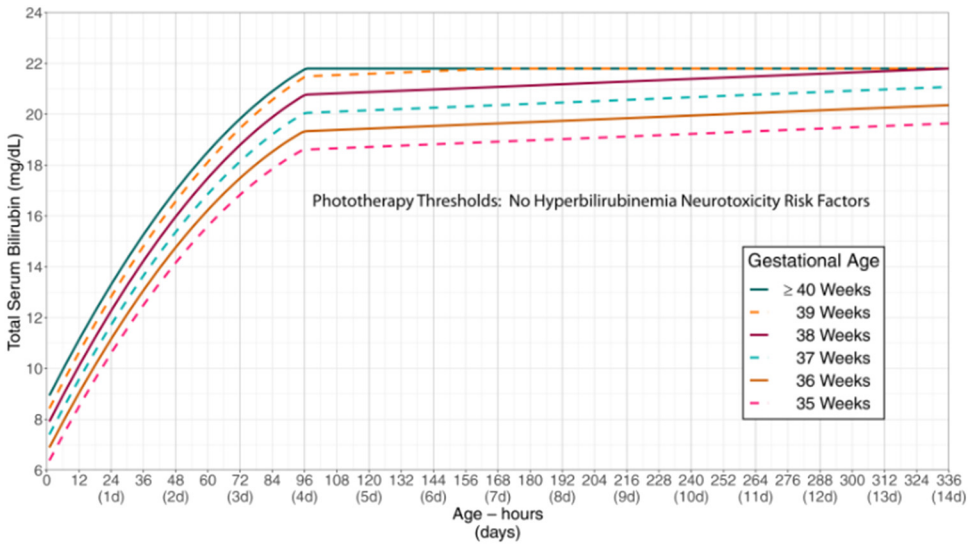
APPENDIX HB-A. PHOTOTHERAPY THRESHOLDS: NO RISK FACTORS



Phototherapy thresholds by gestational age and age in hours for infants with no recognized hyperbilirubinemia neurotoxicity risk factors other than gestational age. These thresholds are based on expert opinion rather than strong evidence on when the potential benefits of phototherapy exceed its potential harms. Use total serum bilirubin concentrations; do not subtract direct-reacting or conjugated bilirubin from the total serum bilirubin. In rare cases of severe hyperbilirubinemia in which the direct-reacting or conjugated bilirubin exceeds 50% of the TSB, consult an expert. Note that infants <24 hours old with a TSB at or above the phototherapy threshold are likely to have a hemolytic process and should be evaluated for hemolytic disease as described in recommendation 14. Hyperbilirubinemia neurotoxicity risk factors include gestational age <38 weeks; albumin <3.0 g/dL; isoimmune hemolytic disease, glucose-6-phosphate dehydrogenase (G6PD) deficiency, or other hemolytic conditions; sepsis; or any significant clinical instability in the previous 24 hours.

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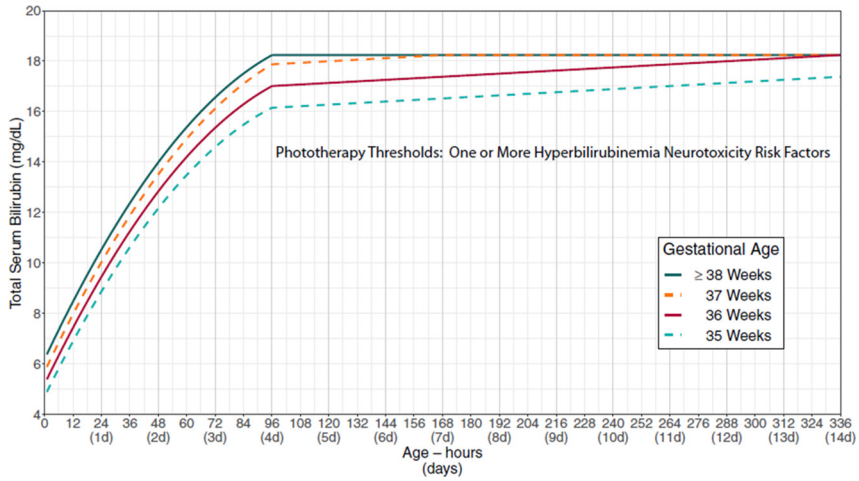
APPENDIX HB-B. PHOTOTHERAPY THRESHOLDS: RISK FACTORS



Phototherapy thresholds by gestational age and age in hours for infants with any recognized hyperbilirubinemia neurotoxicity risk factors other than gestational age. These thresholds are based on expert opinion rather than strong evidence on when the potential benefits of phototherapy exceed its potential harms. Use total serum bilirubin concentrations; do not subtract the direct-reacting or conjugated bilirubin from the total serum bilirubin. In rare cases of severe hyperbilirubinemia in which the direct-reacting or conjugated bilirubin exceeds 50% of the TSB, consult an expert. Hyperbilirubinemia neurotoxicity risk factors include gestational age <38 weeks; albumin <3.0 g/dL; isoimmune hemolytic disease, glucose-6-phosphate dehydrogenase (G6PD) deficiency, or other hemolytic conditions; sepsis; or any significant clinical instability in the previous 24 hours.

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Sepsis

In the newborn, the immune system is comprised of innate and acquired systems. At birth, the innate system is underdeveloped and the acquired system is deficient, which places all neonates at risk for infection, regardless of gestational age (Glaser et al., 2021; Karnati et al., 2020). LPIs are at risk for sepsis because of immaturity of their immune system, inadequate transference of maternal antibodies, impaired skin integrity, and the potential for exposure to pathogenic microorganisms (Verklan, 2021). Early-onset sepsis (EOS) is that which occurs before 72 hours of life, whereas late-onset sepsis is confirmed after 72 hours of life (Glaser et al., 2021).

Recommendation (S1): Assess the presence of maternal and neonatal risk factors that may predispose the LPI to sepsis (see Table S-1).

Rationale: Both maternal and newborn factors can increase the risk of sepsis in the LPI. Factors that increase the risk of sepsis for all newborns, including LPIs, include but are not limited to decreasing gestational age, maternal intraamniotic infection, the duration of rupture of membranes, maternal group B *Streptococcus* (GBS) colonization, and the newborn clinical condition (Glaser et al., 2021: VII; Puopolo et al., 2018: VI; Verklan, 2021: VII). Although EOS is disproportionately greater in preterm infants, data show that in LPIs, EOS only occurs in approximately 1 per 1,000 newborns (Puopolo et al., 2018: VI). GBS is the leading cause of EOS in the newborn population, as approximately 50% of women who have genitourinary or gastrointestinal colonization with GBS will transmit the bacteria to their newborns (ACOG, 2020: VI). Universal screening during pregnancy and targeted intrapartum antibiotic prophylaxis have demonstrated significant efficacy in preventing neonatal EOS related to GBS (ACOG, 2020: VI).

Although much of the literature is related to GBS (Beck et al., 2021: I; Puopolo et al., 2018: VI; Sharma et al., 2019: VI), there are additional reported causes of EOS, including *Escherichia coli*, *Staphylococcus aureus*, and *Listeria monocytogenes* (Puopolo et al., 2018: VI). Intraamniotic infection is associated with EOS and late-onset sepsis. Exposure of the neonate to either histologic or clinical intraamniotic infection during pregnancy has been associated with three- to sixfold increased odds of EOS in newborns (Beck et al., 2021: I). Additionally, preterm newborns may be exposed to an increased number of unnecessary evaluations for sepsis and antibiotic treatment that equates to an approximate 200-fold higher rate than the actual EOS incidence (Kuzniewicz et al., 2016: VII).

Recommendation (S2): Assess the LPI for signs of sepsis (see Table S-2).

Rationale: In addition to the increased physiologic risks for sepsis, the presenting signs of problems common to LPIs, such as hypothermia, respiratory distress, and feeding intolerance, are nonspecific and can often be confused with sepsis (Picone et al., 2014: IV). Newborns with sepsis present with a variety of nonspecific clinical signs that make diagnosis of EOS difficult; the difficulty is even greater with LPIs, as elements of immaturity can mimic EOS (Glaser et al., 2021: VI; Helmbrecht et al., 2019: I). The most common signs of sepsis in neonates can be categorized by systems:

TABLE S-1 MATERNAL AND NEONATAL RISK FACTORS FOR SEPSIS IN LPIs

Maternal	Neonatal
• Prolonged rupture of membranes (>18 h) • Less than 37 completed weeks of gestation • Evidence of intraamniotic infection (triple I), also known as chorioamnionitis • Intrapartum fever > 38°C (100.4°F) • GBS • Herpes simplex virus • Human immunodeficiency virus (HIV) • Previous delivery of an infant with invasive hemolytic GBS disease	• Complications during delivery, such as meconium-stained fluid, need for resuscitation, or asphyxia • Low birth weight (<2,500 g) • Congenital anomalies • Low Apgar scores • Multiple-pregnancy births

Note. A d Current Management Strategies," M. A. Glaser, L. M. Hughes, A. Jnah, & D. Newberry, 2021, *Advances in Neonatal Care*, *21*(1), pp. 49–60 (https://doi.org/10.1097/ANC.0000000000000769). "Management of Neonates Born at ≥35 0/7 Weeks' Gestation With Suspected or Proven Early-Onset Bacterial Sepsis," K. M. Puopolo, W. E. Benitz, T. E. Zaoutis, Committee on Fetus and Newborn, Committee on Infectious Diseases, J. Cummings, S. Juul, . . . T. Q. Tan, 2018 *Pediatrics*, *142*(6), Article e20182894 (https://doi.org/10.1542/peds.2018-2894).

general, respiratory, cardiovascular, neurologic, gastrointestinal, metabolic, and genitourinary. Of note, hypothermia is more common than hyperthermia in the neonate with suspected or confirmed EOS (Glaser et al., 2021: VI; Verklan, 2021: VI).

Recommendation (S3): Determine the risk for sepsis using a validated, age-specific sepsis calculator, such as the Neonatal EOS Risk Calculator (see Figure S-1).

Rationale: A standardized approach for evaluation of EOS in newborns includes the use of the Kaiser Permanente Neonatal EOS Risk Calculator (Helmbrecht et al., 2019: I; Kuzniewicz et al., 2016: VII; Puopolo et al., 2018: VI). The EOS calculator is designed for use in infants born at 34 weeks of gestation or later and produces the probability of EOS per 1,000 infants. This interactive calculator allows clinicians to enter values for specific maternal risk factors as well as the newborn's clinical presentation. Use of the EOS calculator takes into consideration the maternal GBS status and has been shown to be valuable in managing neonates born to mothers diagnosed with intraamniotic infection. Sharma et al. (2019: IV) found, in a cohort study involving more than 5,000 neonates 36 weeks of gestation and greater, that 81% of asymptomatic infants born to a mother diagnosed with intraamniotic infection were able to be managed with their mothers without any antibiotic use after the implementation of an EOS calculator. Collaboration among members of the health care team to review the risk for sepsis and the results of sepsis calculation tools can help providers determine an individualized plan of care. The resulting EOS risk score, along with the newborn's clinical examination, can help guide vital sign monitoring frequency, blood culture requirements, and empiric antibiotic therapy.

The EOS calculator can be accessed via this link: https://neonatalsepsiscalculator.kaiserpermanente.org.

FIGURE S-1 EOS RISK CALCULATOR WITH EXAMPLE

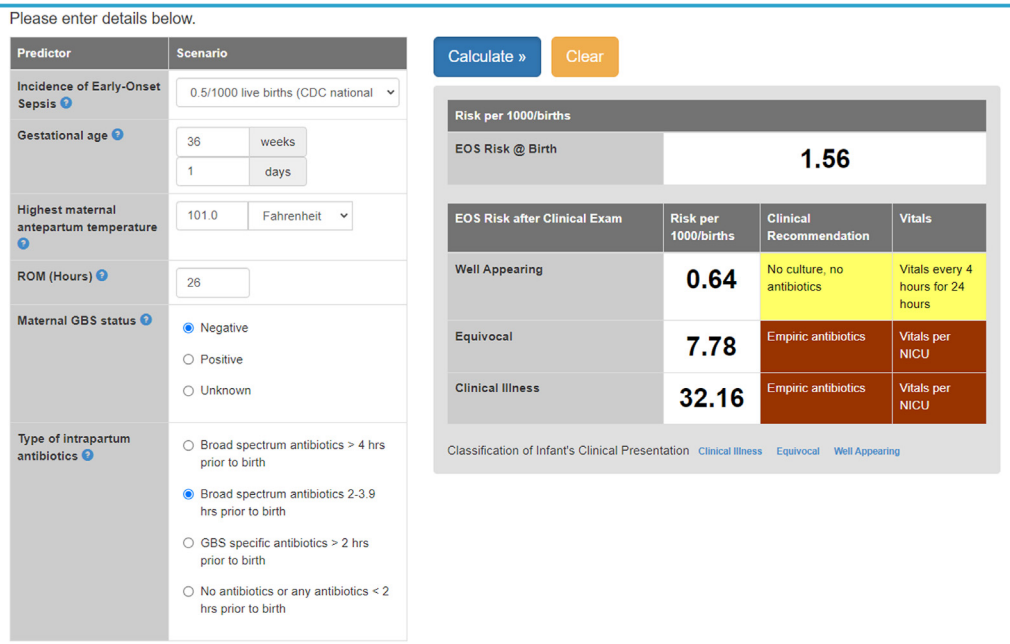

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TABLE S-2 CLASSIFICATION OF CLINICAL PRESENTATION OF EOS

Table 1. Classification of Clinical Presentation	
Clinical illness	1. Persistent need for NCPAP/ HFNC/mechanical ventilation (outside of the delivery room) 2. Hemodynamic instability requiring vasoactive drugs 3. Neonatal encephalopathy/Perinatal depression • Seizure • Apgar Score @ 5 minutes < 5 4. Need for supplemental O_2 > 2 hours to maintain oxygen saturations > 90% (outside of the delivery room)
Equivocal presentation	1. Persistent physiologic abnormality > 4 hours • Tachycardia (HR > 160) • Tachypnea (RR > 60) • Temperature instability (> 100.4°F or < 97.5°F) • Respiratory distress (grunting, flaring, or retracting) not requiring supplemental O_2 2. Two or more physiologic abnormalities lasting for > 2 hours
Well appearing	1. No persistent physiologic abnormalities
NCPAP, nasal continuous positive airway pressure; HFNC, high-flow nasal cannula; HR, heart rate; RR, respiratory rate.	

Note. From "Development and Implementation of an Early-Onset Sepsis Calculator to Guide Antibiotic Management in Late Preterm and Term Neonates," by M. W. Kuzniewicz, E. M. Walsh, S. Li, A. Fischer, & G.J. Escobar, 2016, *Joint Commission Journal on Quality & Patient Safety, 42*(5), pp. 232–239 (https://doi.org/10.1016/s1553-7250(16)42030-1). Used with permission.

Recommendation (S4): Initiate a full diagnostic evaluation for LPIs with clinical signs of infection based on clinical assessment and an age-specific calculator. Evaluation may include but is not limited to the following:

a. Complete blood count (CBC)
b. Blood culture
c. Chest x-ray if respiratory symptoms are present
d. Lumbar puncture

Rationale: A diagnostic evaluation will help determine the appropriate management for LPIs with EOS. Generally, a diagnostic evaluation includes a CBC and blood cultures. Based on the LPI's clinical presentation, a chest x-ray and lumbar puncture may be included. Lumbar puncture for cerebrospinal fluid culture and analysis should be reserved for neonates who are at the highest risk of EOS, such as those with critical illness, and when blood cultures are positive for pathogen growth. The risks and benefits of lumbar puncture should be evaluated and weighed, and the procedure should not be performed if the newborn's clinical condition would be compromised or the procedure would delay antibiotic initiation (Aleem & Greenberg, 2019: VI; Puopolo et al., 2018: VI).

Recommendation (S5): Administer empiric antibiotic therapy, as indicated.

- **Antimicrobial therapy should include agents active against GBS as well as other organisms that might cause neonatal sepsis.**

Note: Antibiotic stewardship will help decrease potential short- and long-term complications associated with neonatal antibiotic exposure.

Rationale: There are no validated, rapid tests that allow the clinician to determine whether a newborn with nonspecific clinical signs does, in fact, have an infection; therefore, ideally, antibiotic therapy should be initiated as quickly as possible in symptomatic newborns (Barrington et al., 2007: VII; Fell et al., 2017: IV). Antibiotic therapy for symptomatic neonates should be directed toward the most common causes of neonatal sepsis, including GBS and other organisms (Puopolo et al., 2018: VI). Ampicillin in combination with an aminoglycoside provides broad-spectrum treatment for suspected or confirmed EOS; if meningitis is suspected or confirmed, ampicillin and a cephalosporin (for improved cerebrospinal fluid penetration) are preferred (Glaser et al., 2021: VI: Puopolo et al., 2018: VI).

It is important to ensure antibiotic stewardship. Complications such as childhood asthma, wheezing, food allergies, inflammatory bowel disease, and obesity have been documented in neonates exposed to antibiotics before and after birth. The developing

microbiome of the neonatal gut may be impacted by antibiotic administration. Therefore, consideration should be given to the initiation and continuation of antibiotic therapy based on EOS risk (Puopolo et al., 2018: VI). A retrospective cohort study evaluating time to positive blood culture collection for newborns born at 34 weeks of gestation or later found the time to positivity of pathogens to be less than 24 hours (Marks et al., 2020: IV). These findings support limiting antibiotic administration in the newborn to prevent antibiotic resistance.

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Discharge Planning and Follow-Up

Recommendation (DP1): Develop a discharge plan of care that includes determination of discharge readiness and optimizes the postdischarge continuum of care.

Rationale: In many cases, the discharge process can be straightforward; however, in newborns with additional risk factors, such as LPIs, the discharge process can become more complicated. A successful discharge plan consists of ensuring the newborn is stable, the family is well prepared to care for the unique needs of the newborn, and follow-up care is established (Hummel & Naber, 2021: VII). The final decision for discharge, which is the responsibility of the attending provider, should be tailored to the unique needs of each individual newborn's situation (AAP & ACOG, 2017: VI).

Recommendation (DP2): Recognize that discharge should not be considered before 48 hours of age for LPIs.

Rationale: LPIs are at risk for cardiorespiratory, thermoregulation, and glucose instability; feeding difficulties; hyperbilirubinemia; and EOS, warranting hospital observation for a minimum of 48 hours (Quinn, 2017: V; Stewart et al., 2019: VI). LPI discharge criteria include achieving physiologic stability and completing newborn screenings. The AAP recommends special considerations in caring for the LPI population, including additional communication and collaboration between perinatal and postpartum care teams (AAP & ACOG, 2017: VI; Stewart et al., 2019: VI). In a large population cohort study, early discharge of LPIs (<48 hours of life) was associated with significantly higher readmission rates up to 28 days after birth (Isayama et al., 2020: IV).

Recommendation (DP3): Ensure the LPI has demonstrated physiologic stability and meets all discharge criteria, including the following:

- **a. The respiratory rate is stable and less than 60 breaths per minute, and the heart rate is between 120 and 160 beats per minute.**
- **b. Axillary temperature is maintained at 36.5°C to 37.5°C (97.7°F–99.5°F) while in an open crib and with appropriate clothing (or while in STS contact) for 24 hours.**
- **c. The LPI demonstrates elimination, defined as voiding as expected for day of life, and at least one spontaneous stool.**
- **d. The LPI is feeding well, defined by coordinated sucking, swallowing, and breathing while feeding, and weight loss does not exceed 7% of birth weight.**

Rationale: Before 48 hours of life, it is unrealistic for the LPI to achieve the minimum criteria for discharge. Because of the risk for cardiorespiratory and thermal instability, adequate time should be allotted for the LPI to achieve physiologic stability and for the health care team to identify potential complications (AAP & ACOG, 2017: VI; Quinn, 2017: V). The LPI should demonstrate physiologic stability prior to discharge. This includes oral feeding sufficient to support appropriate growth, the ability to maintain normal body temperature in a home environment, and sufficiently mature respiratory control (Quinn, 2017: V).

LPIs are born during the stage of lung development when remodeling of the alveoli and bronchiole occurs. Surfactant synthesis and secretion are also affected, predisposing LPIs to respiratory distress syndrome (Verklan, 2021: VI). Normal respiratory effort can vary with the activity of the newborn, with the expected range of 30 to 60 respirations per minute and the absence of increased work of breathing (Tappero, 2021: VI). As heart rate fluctuates, so will cardiac output. Normal term newborn heart rate is 120 to 160 beats per minute, although it may range from 80 to 180 beats per minute on an individual basis, depending on activity levels (Sadowski & Verklan, 2021: VI). Maintaining a stable axillary temperature for at least 24 hours prior to discharge is one indication of discharge readiness (AAP & ACOG, 2017: VI).

Because of weak flexor control and immature musculature, premature infants may be unable to coordinate a suck–swallow–breathe pattern, sustain alert–awake behavior, or maintain cardiorespiratory stability (Parker, 2021: VII). LPIs should consume enough volume orally by discharge to support growth need. Feeding challenges are a primary reason for prolonged hospitalization (Radtke, 2011: V) and rehospitalization (AAP & ACOG, 2017: VI). Weight loss greater than 7% by 3 days of life warrants evaluation and may require additional monitoring, management, and feeding support (Boies & Vaucher, 2016: VI), including for those newborns who are formula feeding. Regular urination and at least one spontaneous stool before discharge are recommended (AAP & ACOG, 2017: VI).

Recommendation (DP4): Develop a discharge feeding plan and ensure the LPI has had at least 24 hours of successful feeding prior to discharge.

- **a. Formally evaluate breast- or chestfeeding and milk transfer.**
- **b. For those LPIs who are human milk feeding, ensure feedings are every 3 hours and at least eight times per day.**
- **c. For those LPIs who are formula feeding, ensure feedings are every 3 to 4 hours and at least six times per day.**
- **d. Supplement with human milk, if needed and whenever possible.**
- **e. Maintain milk supply with use of hand expression or a breast pump in the hospital and at home, once discharged.**

Rationale: Some of the most common reasons for readmission for LPIs include lower gestational age, exclusive breastfeeding, and shorter length of stay after birth, which are all associated with an increased risk for jaundice (Hanin et al., 2022: IV). An individualized hospital LPI breastfeeding plan with a coordinated discharge plan maximizes breastfeeding success (Boise & Vaucher, 2016: VI; Busch & Silbert-Flagg, 2021: VI; Estalella et al., 2020: III) and can reduce readmissions by 80% (Ponto & Kowal, 2020: VI) in LPIs fed with human milk. Assessment of successful LPI breastfeeding incorporates a formal breastfeeding evaluation, including observation of position, latch, and milk transfer during hospitalization (AAP & ACOG, 2017: VI; Boies & Vaucher, 2016: VI; Lober et al., 2020: IV). To assist in maintaining euglycemia, breastfeeding or offering human milk every 2 to 3 hours is recommended (Wight et al., 2021: VI), and the formula-fed newborn should be fed every 3 to 4 hours (Verklan, 2021: VI).

The significant benefits of mother's milk for LPIs warrant encouraging and actively supporting the mother to hand express or use a breast pump to provide milk for their infants if direct breastfeeding is not possible or desired (Parker, 2021: VII). Encourage expressing milk at least eight times in 24 hours; a break in frequency while establishing milk supply may seriously compromise the potential for maximum production (Parker, 2021: VII). Optimal milk expression technique includes a supportive environment for the lactating parent, regular breast massage with good technique, simultaneous pumping of both breasts with a high-quality breast pump, a properly fitting milk expression shield, and the use of hand expression. These combined strategies may increase milk production in the first few days after birth (Parker, 2021: VII).

A quasi-experimental study of 374 LPIs found that the use of a structured intervention with parent education and involvement in breastfeeding decisions, using a multidisciplinary approach that included pumping after feedings, maintaining a feeding diary, and avoiding parent–newborn separation, resulted in a higher incidence of exclusive breastfeeding at discharge ($N = 161$). LPIs in the intervention group were 2.09 times more likely to be exclusively breastfeeding at discharge, and mothers in the intervention group were 2.66 times more likely to be using a breast pump after every feeding (Estalella et al., 2020: III). In another study, LPIs who had exclusive human milk feedings had a shorter length of stay than LPIs who had exclusive formula feedings (Mannel & Peck, 2018: VI).

Recommendation (DP5): Prior to discharge, perform a systematic assessment of the LPI's risk of developing severe hyperbilirubinemia.

- **Provide written and verbal information on jaundice, including the process for follow-up assessment, if indicated.**

Rationale: Early identification and follow-up for neonates at risk of hyperbilirubinemia is an important component of preventing complications (AAP & ACOG, 2017: VI; Kemper et al., 2022: VI; Thanomsingh, 2020: IV). All newborns should have TcB or TSB measured 24 to 48 hours after birth, or prior to discharge, or both (Kemper et al., 2022: VI). Current AAP guidelines recommend using the difference between bilirubin concentration and phototherapy threshold at the time of measurement to determine the interval between discharge, follow-up, and the need for additional TSB or TcB measurements. This approach incorporates both gestational age and other hyperbilirubinemia neurotoxicity risks into the decision-making process (Kemper et al., 2022: VI).

Recommendation (DP6): Ensure all screening tests are completed prior to discharge.

a. **Screen for metabolic and genetic conditions according to state requirements.**
   - **Perform newborn blood spot screening 24 hours after initiation of feedings, and encourage parents to request results from the newborn's primary care provider if not available by discharge.**
   - **Educate parents that additional screening may be indicated.**
b. **Screen for critical congenital heart defects (CCHD) using pulse oximetry no sooner than 24 hours of life.**
c. **Complete car seat tolerance screening to observe for apnea, bradycardia, and oxygen desaturation.**
d. **Ensure hearing screening has been completed or arrangement has been made to complete on an outpatient basis.**

Rationale: All newborns should be screened for any disorders that may lead to morbidity and mortality. Newborn screening for many genetic, hormonal metabolic, and other disorders allows for early diagnosis and treatment that can make the difference between long-term impairment and normal development and healthy life (AWHONN, 2022: VI). Universal pulse oximetry screening for undetected congenital heart defects is the recommended standard of care throughout the United States (AAP, 2023: VI; AWHONN, 2022). It has a 100% sensitivity for ductal dependent lesions, and 50% to 70% of all undiagnosed cases of congenital heart defects will be detected by universal screening (Sadowski & Verklan, 2021: VI). Mandated universal CCHD screening using pulse oximetry has been shown to reduce early infant deaths from CCHD by 33% annually (120 early infant deaths from CCHD averted per year; AAP, 2023: VI). Screening should be completed as close to discharge as possible and after 24 hours of age, as earlier screening may lead to false-positive results (AAP, 2023: VI; Goetz et al., 2016; VI; Sadowski & Verklan, 2021: VI). Universal hearing screening is recommended for newborns. Prompt detection of hearing loss facilitates interventions aimed at preventing speech, language, and cognitive development impairments (AWHONN, 2022: VI; Joint Committee on Infant Hearing, 2007: VII).

LPIs are at risk for cardiopulmonary events while in car seats. In a large retrospective LPI cohort study, cardiopulmonary immaturity was discovered by performing car seat testing, with a 4.6% failure rate among the infant subjects tested (Magnarelli et al., 2020: IV). The AAP recommends that car seat tolerance screening be performed before discharge by hospital staff trained in positioning

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infants properly in the car safety seat, with 90 to 120 minutes (or the duration of the ride home, whichever is longer) of uninterrupted monitoring, to observe for apnea, bradycardia, or oxygen desaturation. LPIs who failed repeat car seat testing frequently had underlying respiratory pathology that necessitated escalation of care (Magnarelli et al., 2020: IV).

Recommendation (DP7): Ensure that an appointment for a follow-up visit is made with the primary pediatric care provider within 24 to 48 hours of hospital discharge.

- **If this postdischarge visit does not coincide with the time frame in which the LPI's bilirubin levels are likely to peak (between Days 5 and 7 of life), an additional follow-up visit should be planned to occur between Day 5 and Day 7 of life.**

Rationale: A successful discharge plan and transition to home facilitates collaborative care after discharge (Hummel & Naber, 2021: VI). LPIs need close follow-up because of their higher risk for readmission for jaundice, feeding difficulties, respiratory distress, and proven or suspected sepsis resulting from physiologic and metabolic immaturity (AAP & ACOG, 2017: VI; Stewart et al., 2019: VI).

Recommendation (DP8): Reinforce the potential need for frequent primary care follow-up visits, developmental evaluation, and referral to a specialist when indicated.

Rationale: LPIs are three times more likely than full-term infants to need intervention for developmental issues (Verklan, 2021: VI). LPIs have been found to be less proficient in reading and mathematics skills, often requiring standardized education plans and special education classes. They may have lower levels of cognitive performance and higher rates of behavioral problems, an increased incidence of cerebral palsy, and increased communication impairments at 18 and 36 months (Verklan, 2021: VI). Early intervention programs have a positive influence on cognitive and motor outcomes during infancy, with cognitive benefits persisting into preschool age (Hummel & Naber, 2021: VI).

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Strength of Clinical Practice Recommendations

These recommendations reflect a summative interpretation of the evidence presented herein, along with the clinical judgment and expertise of perinatal nurses. Each clinical practice recommendation is assigned a strength-of-recommendation score on which the certainty of impact for implementing that recommendation is based. Additionally, the clinical practice recommendation is also assigned a level-of-evidence score, which is determined based on the various levels of evidence cited in the accompanying rationale statements in the Guideline.

Research, however, is not the sole determinant for integrating evidence into practice. To identify the clinical relevance and applicability of these recommendations, the Science Team came to consensus. All selected research was critically analyzed to assess the strength and generalizability while considering the risks and benefits to the woman, fetus, and newborn. Incorporating clinical expertise into this process ensures the applicability of these recommendations into clinical practice.

STRENGTH OF RECOMMENDATION SCORE

A	**Strong Recommendation**	There is high certainty that the recommendation will provide strong benefit to the woman or newborn or both.
B	**Moderate Recommendation**	There is high certainty that the recommendation will provide moderate benefit to the woman or newborn or both.
C	**Weak Recommendation**	There is insufficient or low-level evidence to support universal adoption of the intervention. However, it may be offered based on professional judgment or the woman's preference.
NR	**Not Recommended**	There is strong to moderate evidence to support that the intervention be excluded.
IE	**Insufficient Evidence**	There are insufficient data to make a universal recommendation for this intervention, as it may have limited or unknown effectiveness.

LEVEL OF EVIDENCE SCORE

High	The evidence to support this recommendation is of high quality and includes mostly Level I, II, and III studies, which includes systematic reviews, or meta-analyses of high-quality studies, and randomized controlled trials.
Medium	The evidence to support this recommendation is of moderate quality and includes mostly Level III, IV, V, and VI studies. May also include areas where there is limited high-quality evidence.
Low	The evidence to support this recommendation is weak or of low quality and includes mostly Level VII studies, professional opinion, or case studies. The evidence may also be lacking.

Strength of Clinical Practice Recommendations

Topic (Section)	Recommendation	Strength of Recommendation	Level of Evidence
I. Parent Readiness and Support	**PR1:** Prior to birth, communicate to parents and support people the potential complications and interventions in caring for LPIs.	**B**	**Low**
	PR2: Teach parents and validate their understanding about the special health needs of LPIs affecting their care throughout their hospital stay. These include but may not be limited to the following: a. Signs of respiratory distress b. Interventions that support a neutral thermal environment c. Strategies to prevent infection d. Importance of human milk and feeding issues e. When to alert the health care team	**A**	**Medium**
	PR3: Encourage parent(s) to advocate for their LPI by requesting the following: a. Rooming-in for stable LPIs b. Immediate and sustained skin-to-skin (STS) contact at birth, before feeding, and while in the hospital c. Early support with providing human milk or milk expression, if needed d. An early evaluation with a lactation consultant e. Education and modeling of safe sleep practices f. In-hospital family presence	**B**	**Medium**
II. Gestational Age	**GA1:** Determine the newborn's gestational age with an obstetric estimate using the best available data, which may include: a. last menstrual period (LMP) and b. prenatal ultrasound results.	**A**	**Medium**
	GA2: If the pregnancy dating is suboptimal or there is a discrepancy in the expected gestational age, perform postnatal gestational assessment using an appropriate scoring tool (e.g., New Ballard Score [NBS]). • Ideally, complete the NBS before 12 hours of age.	**A**	**Medium**
	GA3: Obtain the LPI's length, weight, and head circumference and plot the measures on the growth chart to classify the newborn as follows: a. Small for gestational age (SGA) b. Appropriate for gestational age (AGA) c. Large for gestational age (LGA)	**A**	**Medium**

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Strength of Clinical Practice Recommendations

Topic (Section)	Recommendation	Strength of Recommendation	Level of Evidence
III. Respiratory Care	**RC1:** Review perinatal and intrapartum history for maternal and fetal factors that could increase the risk for respiratory distress. a. Maternal conditions include but are not limited to chorioamnionitis (also identified as intrauterine infection, or inflammation, or both, or triple I), gestational diabetes, operative or cesarean birth, and maternal peripartum antibiotics. b. Neonatal conditions include but are not limited to low Apgar scores, male gender, lower gestational age, and multiple-gestation pregnancy.	**A**	**Medium**
	RC2: Recognize that exposure to antenatal corticosteroids may improve respiratory symptoms.	**B**	**Medium**
	RC3: Assess respiratory status immediately after birth.	**A**	**Medium**
	RC4: If respiratory distress symptoms such as tachypnea, retractions, nasal flaring, grunting, decreased perfusion, or cyanosis are present, implement appropriate interventions, such as the following: a. Provide a supplemental heat source, such as STS contact, a radiant warmer, an incubator, or a chemical thermal mattress. b. Assist with the administration of respiratory therapies as ordered, which may include: • supplemental oxygen, • continuous positive airway pressure, or • mechanical ventilation. c. Ensure oxygen is heated and humidified. d. Apply a pulse oximetry monitor (range should be between 91% and 95%). e. Provide blood pressure monitoring. f. Check blood serum glucose levels.	**A**	**Medium**
	RC5: Complete and document a detailed newborn clinical examination and continue to monitor respiratory status.	**A**	**Medium**

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Strength of Clinical Practice Recommendations

Topic (Section)	Recommendation	Strength of Recommendation	Level of Evidence
IV. Thermoregulation	**T1:** Review prenatal and intrapartum history that could increase the risk for heat loss, cold stress, or hyperthermia (see Table T-1).	**A**	**Low**
	T2: Assess parents' knowledge of the benefits of immediate and frequent STS contact.	**B**	**Medium**
	T3: Immediately after birth, initiate actions to maintain and promote a neutral thermal environment.	**A**	**Medium**
	T4: Facilitate immediate, continuous STS contact after vaginal or cesarean birth and continue without separation, whenever possible.	**A**	**Medium**
	T5: Educate parents about and ensure safe parent and newborn positioning, as well as appropriate staff availability, during STS contact (see Table T-2).	**A**	**Medium**
	T6: Provide close observation during STS contact to ensure maternal and newborn safety, including prevention of SUPC: a. Assess LPI for signs of decreased oxygenation, cyanosis, or pallor (including mucous membranes based on skin tone) during STS sessions. b. Monitor newborn vital signs according to facility protocol. c. Consider using a validated tool to assess, monitor, and document the newborn's well-being during STS contact.	**A**	**Medium**
	T7: Monitor axillary temperature per facility protocol.	**A**	**Medium**
	T8: Assess the LPI for cold stress symptoms, including the following: a. Tachypnea b. Apnea c. Color change: pallor, mottling, cyanosis d. Lethargy e. Poor feeding f. Altered pulmonary vasomotor tone g. Metabolic acidosis	**A**	**Medium**
	T9: Rewarm hypothermic newborns according to facility protocol	**B**	**Medium**
	T10: Be aware of the risk factors and signs of hyperthermia.	**B**	**Low**
	T11: Assess the LPI's temperature at least every 4 hours for the first 24 hours and then, if stable, at least once per shift until discharge. • Assessment of vital signs may be individualized based on risk factors.	**B**	**Medium**

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Strength of Clinical Practice Recommendations

Topic (Section)	Recommendation	Strength of Recommendation	Level of Evidence
	T12: Continue to take measures to ensure a neutral thermal environment by avoiding heat loss or overheating.	**A**	**Medium**
	T13: Minimize interruptions in STS contact.	**B**	**Medium**
	T14: Delay bathing until thermal and cardiorespiratory stability has occurred, unless medically indicated.	**A**	**Medium**
V. Hypoglycemia	**HG1:** Review the prenatal/intrapartum history for conditions that increase the risk of hypoglycemia in the LPI (see Table HG-1).	**A**	**Medium**
	HG2: Collaborate to ensure organizational protocols for the assessment and management of neonatal hypoglycemia are developed and implemented.	**A**	**Medium**
	HG3: Monitor the LPI closely for hypoglycemia during the transitional period using point-of-care glucose screening by heel or venous sampling. • Confirm low point-of-care test results with plasma glucose levels.	**A**	**Medium**
	HG4: Monitor for symptoms of hypoglycemia, which may include but are not limited to the following: a. Early signs: sweating, pallor, temperature instability, irritability, hunger, tremulousness, tachycardia, and vomiting b. Late signs: apnea, hypotonia, seizure, and coma	**A**	**Medium**
	HG5: Individualize glucose screenings based on risks and symptoms in LPIs (see Tables HG-1 and Appendix HG-A).	**A**	**Medium**
	HG6: Provide early, frequent feedings on demand, allowing no more than 2 to 3 hours between feedings.	**A**	**Medium**
	HG7: Consider the use of oral dextrose gel to improve blood glucose levels in newborns less than 48 hours of age.	**B**	**Medium**
	HG8: For LPIs with persistent hypoglycemia, those with clinical signs of hypoglycemia, or those who feed poorly or do not tolerate feedings, intravenous glucose may be indicated.	**A**	**Medium**
	HG9: For LPIs with continuing hypoglycemia, consider the need for additional diagnostic testing and possible transfer to a higher-acuity unit or a high-risk facility.	**B**	**Medium**

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Strength of Clinical Practice Recommendations

Topic (Section)	Recommendation	Strength of Recommendation	Level of Evidence
VI. Feeding Challenges	**FC1:** Recognize that LPIs are at increased risk for ineffective breast- or chestfeeding.	**A**	**Medium**
	FC2: Observe and validate the parent's knowledge about common feeding behaviors of LPIs, such as the following: a. Patterns of sucking, including coordination of sucking, swallowing, and breathing b. Need to wake before feedings c. Need for frequent feedings d. Breastfeeding positions e. Need for frequent STS contact f. Importance of monitoring milk intake	**A**	**Medium**
	FC3: Assess readiness to feed before initiating oral feedings using the following behavioral feeding cues: a. Rooting b. Hand-to-mouth movements c. Sucking movements or sounds d. Opening of mouth in response to tactile stimulation e. Transition between behavioral states from sleep to drowsy and quietly alert	**A**	**Medium**
	FC4: Evaluate the LPI's ability to coordinate sucking, swallowing, and breathing, including behaviors demonstrating success or stress.	**A**	**Medium**
	FC5: Facilitate early and frequent feedings. The initial feeding should be within the first hour of birth.	**A**	**Medium**
	FC6: Assess effectiveness of breastfeeding and chestfeeding effort, including milk transfer and oral–motor function, using a validated breastfeeding/chestfeeding assessment tool, such as the following: a. Preterm Infant Breastfeeding Behavior Scale b. LATCH score c. Infant Breastfeeding Assessment Tool (IBFAT) d. Mother/Baby Assessment Tool	**A**	**Medium**
	FC7: Assess and document feeding effectiveness at least twice in 24 hours.	**B**	**Medium**
	FC8: Encourage early and frequent STS contact.	**A**	**Medium**

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Strength of Clinical Practice Recommendations

Topic (Section)	Recommendation	Strength of Recommendation	Level of Evidence
	FC9: Provide supplemental feeding after breastfeeding with appropriate volumes, if medically indicated. Medical indications include but are not limited to the following: a. Excessive weight loss b. Poor feeding c. Hyperbilirubinemia d. Parent–newborn separation	**A**	**Medium**
VII. Hyperbilirubinemia	**HB1:** Recognize that the LPI is at increased risk for developing hyperbilirubinemia and is more susceptible to severe hyperbilirubinemia and kernicterus, with those born at lower gestational ages having the highest risk. • Identify risk factors for severe hyperbilirubinemia and those leading to neurotoxicity (see Table HB-1).	**A**	**Medium**
	HB2: Monitor for risk factors of hyperbilirubinemia (see Table HB-1).	**A**	**Medium**
	HB3: Assess the presence of jaundice in the first 24 hours of life and initiate immediate screening of transcutaneous bilirubin (TcB) or total serum bilirubin (TSB) if visible jaundice is present. • Continue to visually assess LPIs for jaundice during routine assessments.	**A**	**Medium**
	HB4: Plot TcB or TSB levels on an hour-specific bilirubin nomogram to identify the neonate's risk of developing severe hyperbilirubinemia (see Appendices HB-A and HB-B). • If the TcB exceeds or is within 3 mg/dL of the phototherapy treatment threshold, or if the TcB is 15 mg/dL or more, confirm with a TSB.	**A**	**Medium**
	HB5: Ensure that intensive phototherapy is initiated when the neonate's TSB reaches the threshold for treatment based on the hour-specific nomograms, using a family-centered approach.	**A**	**Medium**
	HB6: Consider prophylactic phototherapy or earlier treatment thresholds for LPIs less than 35 weeks of gestation.	**B**	**Medium**

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Strength of Clinical Practice Recommendations

Topic (Section)	Recommendation	Strength of Recommendation	Level of Evidence
	HB7: Obtain additional laboratory values for newborns with hyperbilirubinemia, as ordered by the neonatal care provider.	**B**	**Medium**
	HB8: Encourage frequent feedings.	**B**	**Medium**
	HB9: Repeat TSB assessment throughout the duration of phototherapy and within 12 to 24 hours after discontinuation of phototherapy.	**B**	**Medium**
	HB10: For LPIs being discharged before 1 week of life, obtain and evaluate bilirubin levels on the day of discharge using TcB or TSB levels.	**A**	**Medium**
VIII. Sepsis	**S1:** Assess the presence of maternal and neonatal risk factors that may predispose the LPI to sepsis (see Table S-1).	**A**	**Medium**
	S2: Assess the LPI for signs of sepsis (see Table S-2).	**A**	**Medium**
	S3: Determine the risk for sepsis using a validated, age-specific sepsis calculator, such as the Neonatal EOS Risk Calculator (see Figure S-1).	**A**	**Medium**
	S4: Initiate a full diagnostic evaluation for LPIs with clinical signs of infection based on clinical assessment and an age-specific calculator. Evaluation may include but is not limited to the following: a. Complete blood count (CBC) b. Blood culture c. Chest x-ray if respiratory symptoms are present d. Lumbar puncture	**B**	**Medium**
	S5: Administer empiric antibiotic therapy, as indicated. • Antimicrobial therapy should include agents active against GBS as well as other organisms that might cause neonatal sepsis.	**B**	**Medium**
IX. Discharge Planning and Follow-Up	**DP1:** Develop a discharge plan of care that includes determination of discharge readiness and optimizes the postdischarge continuum of care.	**A**	**Medium**
	DP2: Recognize that discharge should not be considered before 48 hours of age for LPIs.	**A**	**Medium**

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Strength of Clinical Practice Recommendations

Topic (Section)	Recommendation	Strength of Recommendation	Level of Evidence
	DP3: Ensure the LPI has demonstrated physiologic stability and meets all discharge criteria, including the following: a. The respiratory rate is stable and less than 60 breaths per minute, and the heart rate is between 120 and 160 beats per minute. b. Axillary temperature is maintained at 36.5°C to 37.5°C (97.7°F–99.5°F) while in an open crib and with appropriate clothing (or while in STS contact) for 24 hours. c. LPI demonstrates elimination, defined as voiding as expected for day of life, and at least one spontaneous stool. d. LPI is feeding well, defined by coordinated sucking, swallowing, and breathing while feeding, and weight loss does not exceed 7% of birth weight.	**A**	**Medium**
	DP4: Develop a discharge feeding plan and ensure the LPI has had at least 24 hours of successful feeding prior to discharge.	**A**	**Medium**
	DP5: Prior to discharge, perform a systematic assessment of the LPI's risk of developing severe hyperbilirubinemia. • Provide written and verbal information on jaundice, including the process for follow-up assessment, if indicated.	**A**	**Medium**
	DP6: Ensure all screening tests are completed prior to discharge. a. Screen for metabolic and genetic conditions according to state requirements. b. Screen for critical congenital heart defects using pulse oximetry no sooner than 24 hours of life. c. Complete car seat tolerance screening to observe for apnea, bradycardia, and oxygen desaturation. d. Ensure hearing screening has been completed or arrangement has been made to complete on an outpatient basis.	**A**	**Medium**

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Strength of Clinical Practice Recommendations

Topic (Section)	Recommendation	Strength of Recommendation	Level of Evidence
	DP7: Ensure that an appointment for a follow-up visit is made with the primary pediatric care provider within 24 to 48 hours of hospital discharge. • If this postdischarge visit does not coincide with the time frame in which the LPI's bilirubin levels are likely to peak (between Days 5 and 7 of life), an additional follow-up visit should be planned to occur between Day 5 and Day 7 of life.	**B**	**Medium**
	DP8: Reinforce the potential need for frequent primary care follow-up visits, developmental evaluation, and referral to a specialist when indicated.	**B**	**Low**

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