Bridging the NICU to Home:
A Team-Based Approach to Infant Discharge and Follow-Up Care

Activity 2

Caring for NICU Graduates in the Primary Care Setting

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Introduction and Background

- **Discharge is a milestone, not a finish line**
  - NICU graduates go home with incomplete growth, accrued nutritional deficits, and developmental risk that persist well beyond the unit
- Building on Activity 1, which addressed preparing and discharging the preterm infant from the NICU, this activity shifts to **primary care of the preterm infant**, covering:
  - The unique needs of former preterm infants
  - Primary care for NICU graduates, including postdischarge follow-up, monitoring growth, and optimizing nutrition
  - Neurodevelopmental concerns and ongoing surveillance

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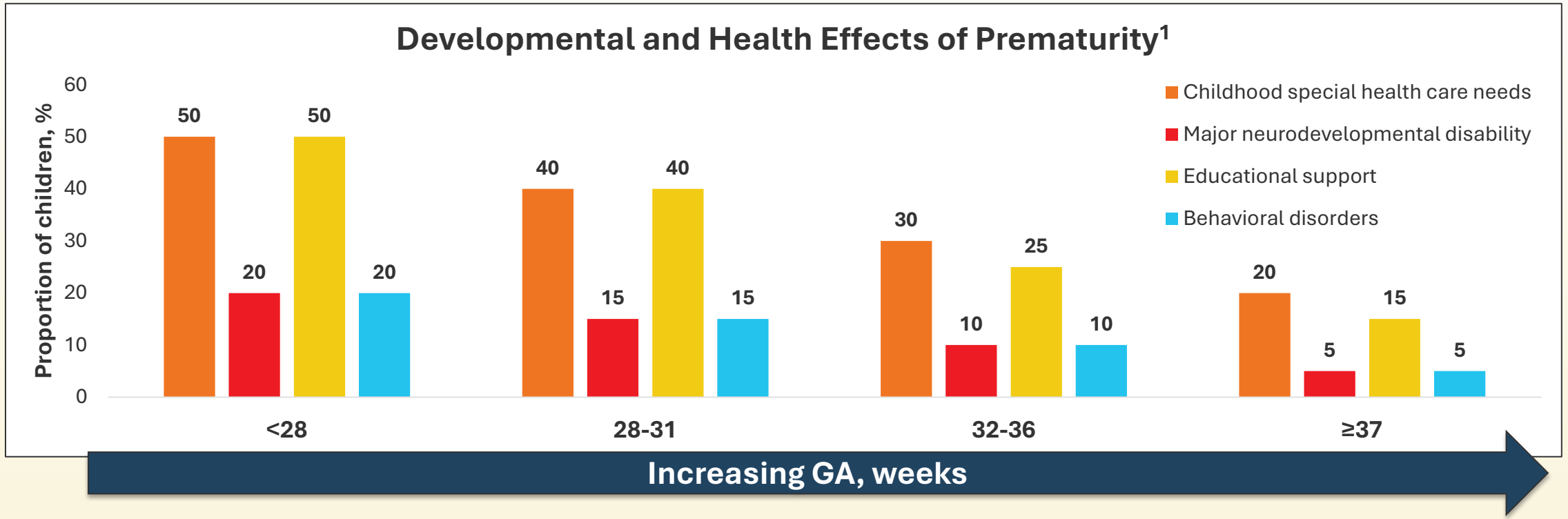
The Unique Needs of Former Preterm Infants: Effects of GA on Developmental Outcomes



GA, gestational age.

1. Msall ME et al. In: Halfon N et al, eds. *Handbook of Life Course Development*. Springer; 2018. **2.** Hochstedler KA et al. *Am J Perinatol*. 2021;38(10):1088-1095.

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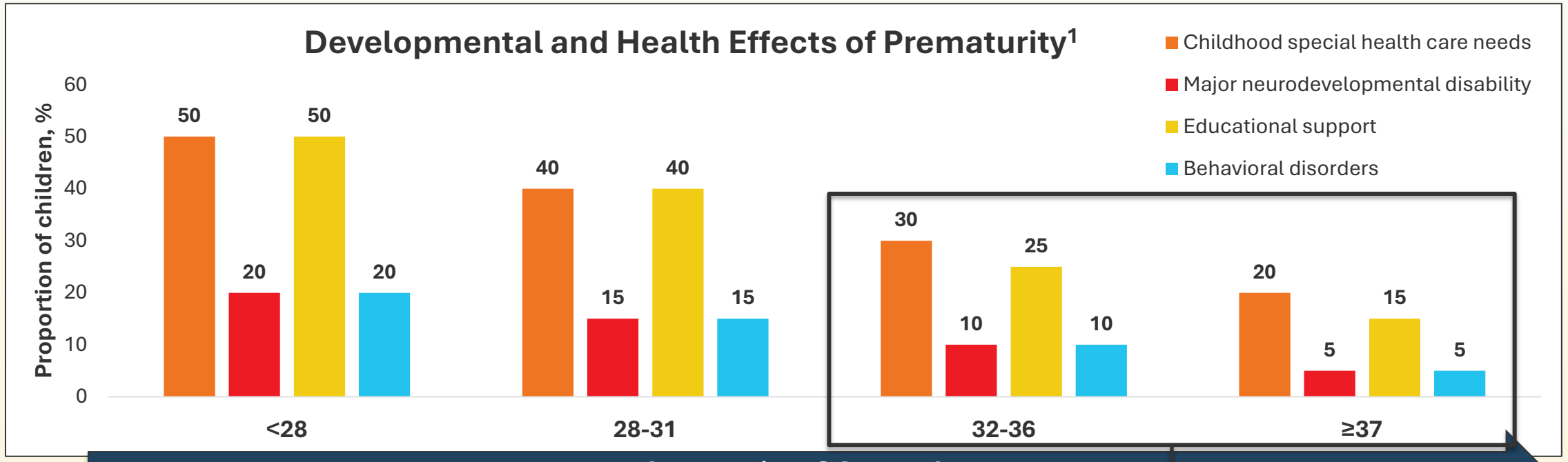

Elevated risk of developmental delay, even among late preterm and early term infants[2]

↑2.4×	↑1.4×	↑1.4×	↑1.3×
32-34 weeks	35-36 weeks	37 weeks	38 weeks

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The Postdischarge NICU Nutritional Challenge: Optimizing Growth to Support Development

Improving postdischarge growth can reduce the risk of adverse cognitive and motor outcomes, but meeting nutritional needs can be challenging.

Many preterm infants discharged before 40 weeks' adjusted age require catch-up growth, which is complicated by:

- Accrued deficits in protein, energy, and vitamins and minerals
- Insufficient nutrients (especially protein) in mature mother's own milk
- Reduced muscle control and easily fatigued

~40%

VLBW infants (<1500 g) have fallen ≥1 full SD below birth-weight parameters at discharge

>50%

VLBW infants <1000 g have fallen ≥1 full SD below birth-weight parameters at discharge

SD, standard deviation.

Stellwagen LM et al. In: Berkowitz CD, ed. *Berkowitz's Pediatrics: A Primary Care Approach*. American Academy of Pediatrics; 2020.

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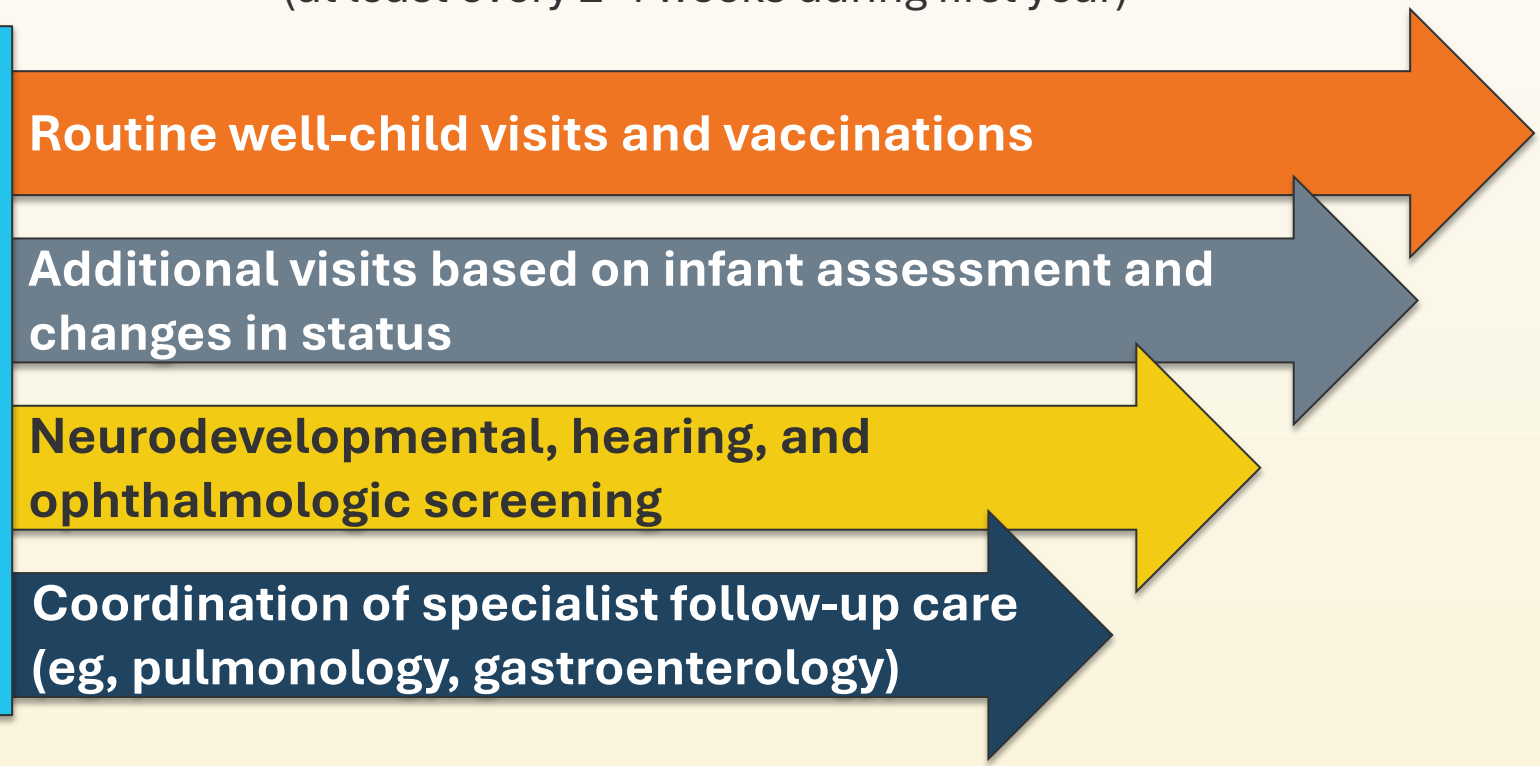
Evidence-Based Primary Care for NICU Graduates

Components of Postdischarge Follow-Up

First PCP Visit
(within days of discharge)

- Evaluate transition from NICU to home
- Assess infant's medical needs
- Review NICU-prescribed nutrition plan
- Develop postdischarge follow-up plan

Ongoing Follow-Up
(at least every 2-4 weeks during first year)



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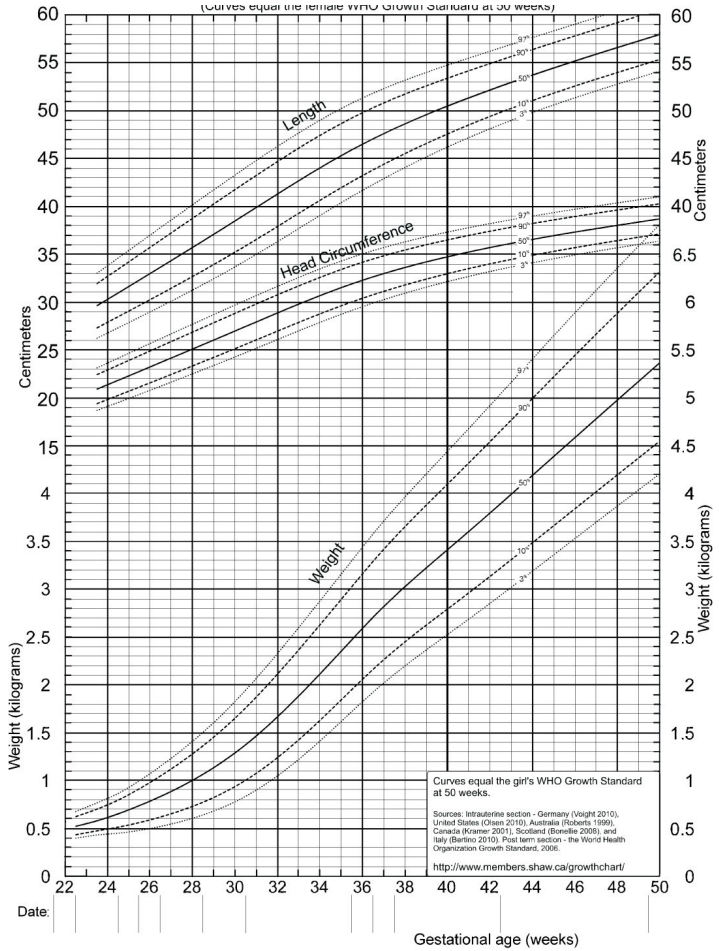
Charting and Monitoring Growth

- Growth targets should be individualized and, ideally, **approximately parallel** growth curves on reference standards[1-3]
  - Continue to plot growth on Fenton chart as able per corrected gestational age (CGA)[2]
  - Transition to WHO growth chart at 50 weeks' CGA[2]
  - Use corrected age until ≥2 years of age[2]
- Typical growth targets for healthy full-term infants may **not** reflect appropriate growth for former preterm infants[1]

Fenton Fetal-Infant Growth Chart for Preterm Girls[4]



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1. Fenton TR et al. *J Pediatr*. 2018;196:77-83. **2.** Stellwagen LM et al. In: Berkowitz CD, ed. *Berkowitz's Pediatrics: A Primary Care Approach*. American Academy of Pediatrics; 2020. **3.** Fenton TR et al. *Semin Perinatol*. 2026;50(4):152228. **4.** Fenton TR, Kim JH. *BMC Pediatr*. 2013;13:59.

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Postdischarge Formulas and Ongoing Nutrient Enrichment

Many preterm infants **will struggle to meet nutritional needs** with MOM or term formula alone

Volume intake may be limited by developmental delays

Infants at the highest risk for growth faltering and with the greatest need for nutrient enrichment include those with:

- Major growth restriction
- Chronic illness
- Gastroesophageal reflux
- Nutrient deficiencies at time of discharge
- Oromotor dysfunction

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Nutrient Enrichment and Mother's Own Milk Fortification

	Fortification Strategies				Target amount (3-kg infant with intake of 200 mL/kg/d)
Mature MOM in diet	**100%**	**75%**	**50%**	**0%**	
Formula	—	**PDF** (2 bottles, 150 mL)	**PDF** (4 bottles, 300 mL)	**PDF** (8 bottles, 600 mL)	
Energy	405	415	426	448	**285**
Protein, g	5.4	7.2	8.9	12.6	**6**
Calcium, mg	135	218	301	500	**315**
Phosphorous, mg	78	127	177	285	**189**

Tailor nutrient enrichment plan to CGA, growth, MOM volume, and caregiver factors (eg, cost, safety, simplicity).

MOM, mother's own milk; PDF, post-discharge formula.

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Structured Assessment of the Home Feeding Plan

In the first weeks postdischarge, address the ABCs of breastfeeding (attachment, breast milk production, and calories) in reverse order, focusing on calories first.

Calories

- ❑ Over the last few days, roughly how many times a day have you been nursing?
- ❑ How do you judge whether the baby has taken enough at a given feeding?
- ❑ Are you giving any additional milk from a bottle?
- ❑ If so, what are you using? How much, and how often?

Breast milk production

- ❑ How often are you currently pumping?
- ❑ Do you pump after the baby has nursed?
- ❑ When you express, are you making more or less than the baby needs for those extra feeds?
- ❑ If you're making more than needed, would you like to cut back on how often you pump?
- ❑ If you're falling short, would you like help increasing your supply?

Attachment

- ❑ Is the baby having any trouble latching on or staying latched through a feed?
- ❑ Are you using, or have you tried, a nipple shield to help the baby stay on the breast?
- ❑ Do you know who to contact if you need help getting the baby to latch?

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Nutritional Concerns Beyond Growth

Vitamin D

- 400 IU/day for infants receiving MOM (regardless of fortification)
- For PDF-fed infants, continue vitamin D supplementation until 1 L/day of intake

Iron

- 2 mg/kg/day for the first year
- Continue until infant's diet consists of iron-fortified term formula or when complementary feeding supplies sufficient iron

Bone health

- Human milk fortification for 12 weeks after discharge supplies calcium and phosphorous, improving bone health

Feeding issues

- GERD—begin with behavioral interventions, followed by thickening of feeds
- Constipation—often self-limited but may benefit from gentle osmotic laxative

Stellwagen LM et al. In: Berkowitz CD, ed. *Berkowitz's Pediatrics: A Primary Care Approach*. American Academy of Pediatrics; 2020.

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Neurodevelopmental Concerns and Ongoing Surveillance

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Neurodevelopmental Risk Stratification

	Cerebral palsy	Visual impairment	Hearing impairment	Intellectual disability
Gestational age				
<28 weeks				
28-31 weeks				
32-36 weeks				
≥37 weeks				
Comorbidities				
HIE or PVL				
NEC				
Grade 3-4 IVH				
Grade 1-2 IVH				
ROP requiring surgery				
Moderate-to-severe BPD				
Mild BPD				

Risk (Incidence vs General Population)

- Very high risk *(10-40× higher incidence)*
- High risk *(5.0-9.9× higher incidence)*
- Moderate or low risk *(1.1-4.9× higher incidence)*
- No added risk

BPD, bronchopulmonary dysplasia; HIE, hypoxic ischemic encephalopathy; IVH, intraventricular hemorrhage; PVL, periventricular leukomalacia; ROP, retinopathy of prematurity.

Davis BE et al. *Pediatrics*. 2023;152(1):e2023062511.

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Identifying Developmental Delays: Timing Is Everything

Early detection of developmental delays accelerates access to Early Intervention programs during a critical period of neural plasticity, potentially altering the developmental trajectory.[1]

- In a meta-analysis, early intervention programs **improved cognitive outcomes** in former preterm infants at preschool age[2]
- **Ongoing enhanced surveillance** in the former preterm infant is critical for timely detection of developmental delays[1]

Examples of Early Intervention services:

- PT and/or OT
- Speech-language pathology
- Vision and audiology services
- Nutrition services
- Support to improve infant-caregiver relations

OT, occupational therapy; PT, physical therapy.

1. Davis BE et al. *Pediatrics*. 2023;152(1):e2023062511. **2.** Orton J et al. *Cochrane Database Syst Rev*. 2024;2(2):CD005495.

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Enhanced Surveillance and Screening Recommendations for Former Preterm Infants

	0-9 months	9-18 months	18-24 months	24-30 months	2.5-5 years
Caregiver concerns	Discuss caregiver concerns and perform targeted evaluation				
Ongoing surveillance for...					
Vision impairment	Nystagmus, not tracking movement	Nystagmus, poor visual attention, not reaching or grabbing	Strabismus, visual acuity differences		Strabismus, visual acuity differences
Hearing loss	Not alerting to sound or voice	Not localizing sound or voice, not responsive to name	Not orienting to sound or voice, delayed speech or language		Signs of mild or unilateral hearing loss
Cerebral palsy	Asymmetry, persistent fisting (>3 months), not reaching	Asymmetric hand use, posturing, not sitting, atypical crawl	Asymmetric gait or hand use, not walking		Lack of coordination, clumsiness, fine motor or adaptive skill delays
Intellectual disability	Difficult to assess	Global developmental delay	Global developmental delay		Signs of mild or borderline delay
Later-onset developmental disabilities	Difficulty feeding or sleeping	Delayed speech or language, social delay	Delayed speech or language, social delay		Impairment due to hyperactivity, anxiety, social interaction, etc

Screening Recommendations for all children

- General development screening (9 months)
- General development and ASD screening (18 months)
- ASD screening (24 months)
- General development screening (30 months)

Davis BE et al. *Pediatrics*. 2023;152(1):e2023062511.

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Caregiver Counseling and Reassurance

Provide realistic counseling regarding developmental risks

- Ground guidance in the patient's individual risk profile
- Avoid overstating risks or providing false reassurance
- Always highlight progress and strengths

Enhanced surveillance allows for reassurance at common milestones

- Severe sensory impairment and cerebral palsy typically presents by 12-18 months with appropriate screening
- Most severe developmental disabilities present by 24-30 months

Lower-severity developmental disabilities can present later

- Examples include language and speech disorders, ADHD, and internalizing or externalizing behaviors

Davis BE et al. *Pediatrics*. 2023;152(1):e2023062511.

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Key Concepts

- **Lower GA** is associated with **greater risk of developmental delays**, but the risk remains elevated even for late-preterm infants
- **Communicate with the NICU** to obtain nutritional history, medical history, and discharge plan
- **Growth goals** in former preterm infants should be individualized and, ideally, should **approximate growth curves** on an appropriate reference standard
- **Nutritional enrichment** is **key for catch-up growth** in former preterm infants
  - Typically requires supplementation with postdischarge formula or another fortification strategy
- **Monitor for developmental delays** and initiate prompt referrals as needed

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