



**WISCONSIN  
ASSOCIATION FOR  
PERINATAL CARE**

**COMMUNITY  
PROVIDER SUPPORT  
OF GROWTH IN  
PREMATURE INFANTS**

**PREPARED BY**  
WAPC NUTRITION COMMITTEE

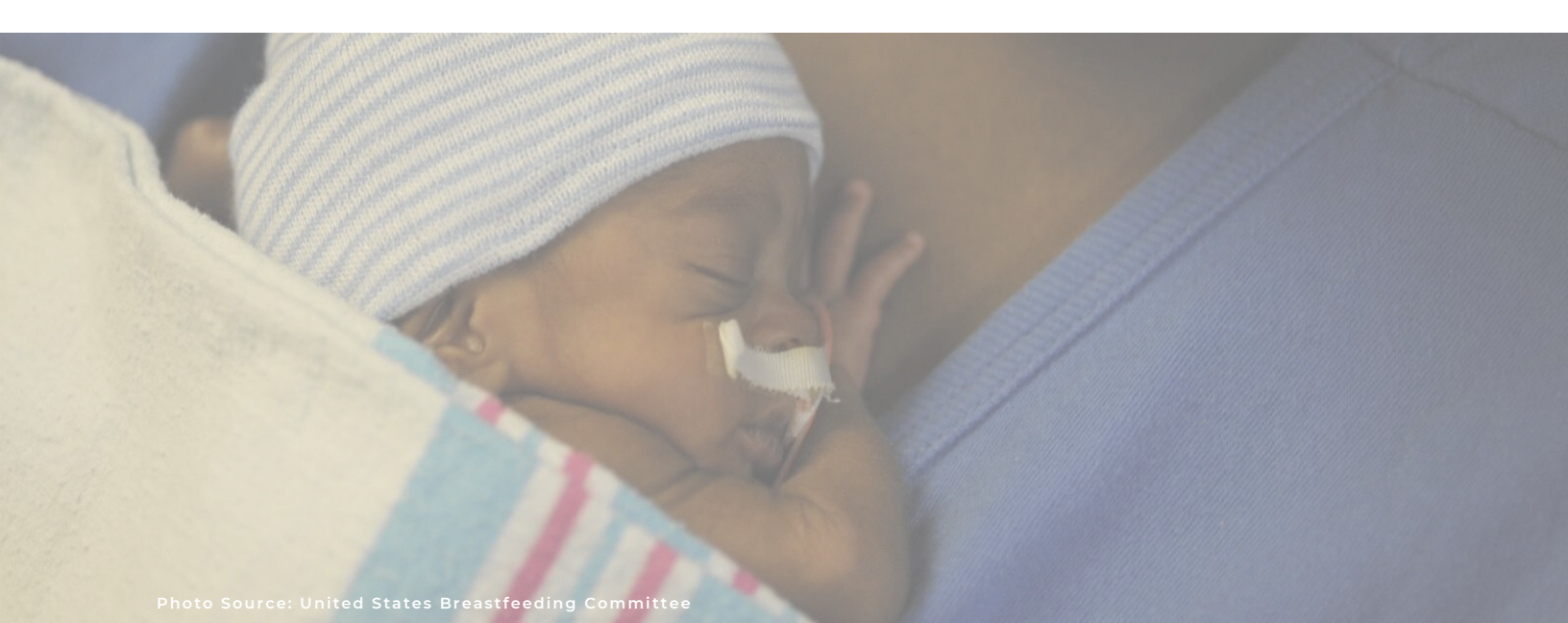


Photo Source: United States Breastfeeding Committee

Community care providers are critical in supporting premature infants and their families in attaining healthy outcomes. These providers include primary physicians (family physicians and pediatricians), public health nurses, nurse practitioners, Birth to 3 providers, registered dietitian-nutritionists, and WIC nutritionists.

Growth is a reflection of a young child's well-being. Compared to appropriate growth, inappropriate growth is more often associated with neurocognitive development, percentage body fat, insulin resistance, other cardiovascular risk factors<sup>1,2,3</sup>, and infection risk.<sup>4</sup> Quality of care affects growth.<sup>5</sup> Evidence-based care to support growth begins with adjusting a premature infant's chronological age for prematurity. Quality care includes close monitoring of growth parameters to allow for early recognition of an abnormal trajectory, immediate efforts to encourage appropriate growth, (e.g., nutritional supplementation), and early detection and treatment of illness.

### **The purpose of this statement is**

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To describe the method for adjusting an infant's age for prematurity.

To define appropriate parameters for monitoring an infant's growth.

To provide resources and intervention strategies for community care providers in their efforts to support optimal growth in premature infants.





## Adjusting age for prematurity

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Adjusting age for prematurity (birth prior to 37 weeks' gestation) helps health care providers set realistic expectations for the infant's growth and development. Providers can then communicate these expectations to parents and other individuals caring for the infant. Throughout the first two to three years of life, premature infants are likely to exhibit lower than average weight and length unless allowance is made for gestational age. Therefore, what is normal may not seem normal unless one adjusts for prematurity.

### Tips for adjusting an infant's age for prematurity

Use infant's due date for calculating adjusted age. For example, an infant born on May 30 and due on June 30 would be approximately 1 month old (or 4 weeks) on July 30.

Round off the adjusted age to the nearest week.

Continue to adjust at least through 24 months (or 2 years).

### Plotting anthropometric measurements

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It is important to plot an infant's measurements routinely on a consistent growth chart.<sup>6,7</sup> Incremental weight charts (measuring velocity) provide more graphic illustration than standard growth charts regarding the changes in weight over time.<sup>8</sup> Fenton and Olsen growth charts are appropriate for premature infants. Current growth charts (weight for age, length for age, head circumference for age, weight for length), available in English, Spanish, and French, can be downloaded from <http://www.cdc.gov/growthcharts/>.



## Tips for obtaining accurate and reliable measurements

Measuring length requires two people and a length board with a head and foot piece. One person holds the head in position: the second person straightens the knees and brings the ankles to a right angle with the foot piece. Read the measurement to the nearest 0.1 cm or 1/8 inch. Repeat the measurement twice or until two measurements agree within 0.2 cm or 1/4 inch. Record the average of the two closest measurements. Lengths done on exam tables using a tape measure are approximations at best, and often useless in tracking growth accurately.

Weigh on a digital scale.

## Assessing for signs and symptoms of malnutrition

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Malnutrition is determined by the relationship between food/nutrient intake and energy/protein needs; anthropometric measurements, including assessment of growth velocity; and baseline functional status (handgrip strength).<sup>9</sup> Further, a Nutrition-Focused Physical Examination, including consideration of fat and muscle stores, skin integrity, and muscle tone, provides additional information on the impact of malnutrition.<sup>10</sup>



## Measuring and plotting BMI

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Experts recommend following the Body Mass Index (BMI) because of its accessibility and correlation with total body fat and risk factors for obesity-related morbidity.<sup>11</sup> BMI is defined as the individual's body weight (kg) divided by the square of his or her length/height (m). Calculating BMI of an infant requires accurate measures of weight and recumbent length/height. BMI tables, nomograms, and calculator programs are available from a number of sources for older children and adults. BMI curves for preterm infants have been generated.<sup>12, 13</sup>

## Online resources for BMI tables, nomograms

[Body Mass Index \(BMI\) for age \(WHO\)](#)

[BMI Tools \(CDC\)](#)

[BMI Calculator \(NIH\)](#)

[PediTools](#)

[Pediatric Z-Score Calculator \(CHOP\)](#)





## Growth faltering

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Growth faltering means that attained growth is inadequate or growth velocity is reduced compared to expected growth velocity. Alternatively, growth faltering describes the situation when one or more parameters drop two or more channels on the growth chart (e.g., from the 50-75th percentiles to the 5-10th). Generally, growth faltering happens first in weight, then length, then head circumference. Birth size, rate of growth in the 6- to 18-month period, overall growth by 18-24 months of age, and head circumference were associated with 24-month cognitive scores.<sup>14</sup>

Early identification and close monitoring of growth faltering, combined with appropriate nutritional support is associated with improvements in both infant growth and development.<sup>15</sup> Further, faster growth during the critical early period in late-preterm infants is associated with improved adult neurocognitive functioning.<sup>16</sup>

Sometimes clinicians are deceived about growth by how a baby looks, or the clinician might think, "Well, the parents are small." Remember, to judge adequate growth, you need accurate anthropometric measurements.





## Catch-up growth

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### Inadequate

A premature infant's weight, length, and head circumference frequently fall below the 50th percentile when plotted on a growth grid, even when the infant's age is adjusted for prematurity. The distance between the infant's actual growth and the 50th percentile is considered to be his or her growth potential, or the gap that needs to be closed in order to say that the infant has "caught up" with peers. Catch-up growth is dependent on growth velocity (the rate of change in growth over time) that exceeds expected velocity. Factors that influence catch-up growth include gestational age at birth, size for gestational age at birth, genetic potential, neurological injury, illness, and nutritional intake. Generally, catch up occurs first in head circumference, then length, then weight. Research suggests that early appropriate postnatal weight gain is associated with improved neurodevelopmental outcomes of infants born moderately premature, premature and small for gestation, and small for gestation at term.<sup>17, 18</sup>

### Excessive

Research suggests an association between rapid postnatal weight gain and the metabolic syndrome.<sup>3, 19</sup> Specifically, high-protein intake during the first two years and later is associated with obesity.<sup>20</sup> Increased global and central adiposity have been associated with rapid postnatal weight gain in both premature and full-term infants, changes which increase concerns about the development of insulin resistance and the metabolic syndrome.

Preterm birth<sup>21</sup> and intrauterine growth restriction<sup>22</sup> are just two of many factors associated with metabolic syndrome. Beyond infancy, many of the factors are related to lifestyle and behavior and are amenable to intervention programs.<sup>23</sup> Thus, there is insufficient evidence at this time to recommend sub-maximal nutrition support for premature infants, but further study is necessary.

## Considerations

**Appropriate catch-up growth is positively associated with improved neurodevelopment in some infant groups**

**Excessive catch-up growth is positively associated with metabolic syndrome in adults**

**The risk-benefit of faster postnatal growth may differ in different populations<sup>24</sup>**

## Providing optimum nutrition to premature infants


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Breast milk is the nutrient of choice for premature infants.<sup>25,26</sup> Breast milk protects against infection, is easily digested and well tolerated, contains species-specific nutrients, enhances cognitive development, and reduces cost of both health care and infant feeding.

- Nutritional management plans of premature infants should consider parents' feeding goals and support ongoing lactation in the human milk fed infant.<sup>27,28</sup>
- Nutritional management of premature infants should consider such factors as degree of prematurity, physiologic maturity, and presence of other medical conditions which could affect metabolic demands.<sup>27</sup>
- Preterm infants (including late preterm infants) should be monitored for growth every month until six months' corrected age.<sup>28</sup>
- Premature infants who are breastfed, as well as those fed either breast milk or formula, may need additional calories and nutrients through supplementation or fortification.<sup>28,29,30,31</sup> Adjustments in feedings should be individualized to the infant's growth, feeding abilities, and nutritional history.<sup>27</sup> Consultation with someone with expertise in premature infant nutrition and growth may be necessary to determine appropriate fortification needs. Registered Dietitian Nutritionists in neonatal intensive care units are a potential source of information.<sup>27</sup> In addition, some maternal/infant dyads may benefit from support from lactation consultants after discharge.<sup>27</sup>
- Expert opinion has concluded that infants born weighing < 1000 g and discharged before 2000 g will require fortification of both human milk and formula and consideration given to continue this for a minimum of 12 weeks after discharge.<sup>32</sup>

According to the American Academy of Pediatrics, Pasteurized donor human milk (PDHM) can be considered in situations in which maternal milk is insufficient.<sup>33</sup> Unpasteurized donor milk is not recommended due to potential for bacteriological or viral contamination.<sup>34</sup> PDHM is becoming more readily available for purchase from Human Milk Banking Association of North America (HMBANA)-approved milk banks. The effect of PDHM on incidence of necrotizing enterocolitis and infant growth compared to maternal milk is uncertain. While some studies suggest superiority of maternal milk on growth and development<sup>35</sup> and prevention of surgical necrotizing enterocolitis<sup>36</sup>, other studies demonstrate no significant differences on growth and necrotizing enterocolitis in very low birth weight infants.<sup>37,38</sup> The conflicting results suggest PDHM is not a proxy for maternal milk.





## Providing optimum nutrition to premature infants continued...

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Premature infants are often discharged to home on nutrient-enriched formula to facilitate “catch-up” and/or optimal growth. Available evidence does not support discharging preterm infants on a “post-discharge formula.” There is limited evidence that discharge on “preterm formula” may support increased growth up to 18 months post term.<sup>31</sup>

## Opportunities for quality improvement

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Patient care provides opportunities for improving quality and outcomes. Within the hospital, quality improvement initiatives can focus on use of standardized protocols for feeding, including initiation, advancing, use of maternal milk, and other variables. Outcome measures may include reduction of growth restriction<sup>39</sup> and other clinically relevant variables. Within the community, there are opportunities to evaluate the effectiveness of patient discharge instructions and communication to the outpatient provider team.<sup>28</sup>

## Additional Resources

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American Academy of Pediatrics, Committee on Nutrition. Pediatric Nutrition, 8th Edition. Elk Grove Village: American Academy of Pediatrics, 2019.

[Gaining and Growing: Assuring Nutritional Care of Premature Infants](#)

[Nutritional Support of the VLBW Infant Toolkit \(CPQCC\)](#)

Vermont Oxford Network - "Optimizing Nutrition and Decreasing Necrotizing Enterocolitis", Summary Toolkit, 2018-2019. (Available to members of the Vermont Oxford Network)

## Summary

The goal of monitoring the growth of premature infants is two-fold: to prevent or arrest growth faltering and to improve the odds of achieving an intrauterine rate of weight gain in a timely manner. Although an intrauterine rate of weight gain is often achievable prior to NICU discharge, if it is initially delayed or falters during the hospital course, catch up growth may be prescribed. The optimal rate and timing of catch up growth are not well defined. However, the current evidence favors the support of postnatal catch up growth for improved neurodevelopmental outcomes over the long-term negative effects of catch up growth on metabolic outcomes.

For the premature infant who is already living in the community at large, family and health care services should focus on provision of nutrients to support appropriate catch-up growth, while considering parents feeding goals and supporting ongoing lactation in the human milk fed infant. While not every premature infant will achieve the 50th percentile, or even the 10th percentile weight, length, and/or head circumference for adjusted age, with few exceptions, the goal should continue to be achievement of, or return to, the growth pattern the infant would have followed if he or she had been born at term.





## Acknowledgements

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