

135 Slowed/Faltering Growth Pattern

Definition/Cut-off Value

Slowed/Faltering Growth is defined as:

Age	Cut-Off Value
Infants Birth to 2 Weeks	Excessive weight loss after birth, defined as $\geq 7\%$ birth weight (1, 2).
Infants 2 weeks to 6 Months of Age	Any weight loss. Use two separate weight measurements taken at least eight weeks apart (3).

Participant Category and Priority Level

Category	Priority
Infants ≤ 6 Months of Age	I

Justification

Growth faltering is defined as a growth rate below that which is appropriate for an infant's age and sex. It can affect length, weight, and head circumferences resulting in values lower than expected. Growth faltering may include weight faltering (a drop in weight-for-age) or slowed growth where both weight and length growth are slower than expected. An example of weight faltering is a drop in weight after a minor illness or a measurement/plotting error (4).

Growth in infants is steady and predictable. It is a reflection of health and nutritional status and the overwhelming majority of infants have no growth problems (5, 6). Normal growth is also pulsatile, with periods of rapid growth or growth spurts followed by periods of slower or no measurable growth (5-8). Catch-up and catch-down growth during early childhood are normal phenomena that affect large numbers of children, particularly during infancy, and may merely be an adjustment to the genetic potential for growth (9). Growth is also seasonal, with length velocities (the change in growth over time) increased during the spring and summer months and stagnant other months (10). Weight may vary depending on the time of day and infant feeding schedule. Growth may be increased or slowed by a variety of conditions, with changes in growth as the first sign of a pathological condition. Such conditions include: undernutrition, hypothyroidism, iron deficiency, human immunodeficiency virus (HIV), inborn errors of metabolism, lead toxicity, zinc deficiency, immune deficiency, failure of a major organ system such as the gastrointestinal digestive system, renal, cardiovascular, and pulmonary (11). Infants that do not follow a steady predictable pattern, such as those with short stature or decreased growth rate, should be the focus of concern (11).

The timely detection of poor growth in early life is a way to identify infants who may be at risk for growth faltering, and intervene before undernutrition has detrimental health outcomes, such as growth retardation, when incurred early are irreversible (12). It can help prevent short stature and adverse functional and deleterious long term consequences, such as poor cognition and educational performance, low adult wages, lost productivity, and when accompanied by weight gain later in childhood, an increased risk of nutrition-related chronic diseases (13, 14).

Excessive Weight Loss After Birth

Infant weight loss in the early postpartum period is physiologically normal, and nearly universal but the amount of weight loss varies (15). Weight loss of 5% and 7% of birth weight is not unusual for formula-fed or breastfed infants, respectively (16). Healthy infants are expected to regain their birth weight within 8-10 days after birth (17). However, if a breastfed infant loses 7% of birth weight in the first 72 hours after birth, an evaluation and review of the mother-infant dyad is needed and any problems resolved immediately. Risk of dehydration and failure to thrive in breastfed newborns can be mitigated by early screening and providing lactation support in the early postpartum period (18).

A weight loss of up to 10% of birth weight is the maximum acceptable weight loss for newborn infants, with any additional loss a potential emergency (17, 19). Contributing factors include (2, 16, 17, 20):

- Hospital practices like epidurals, pacifier use, low or non-nutritive feedings, or strict feeding schedules.
- Maternal factors such as retained placenta, parity, anxiety, and poor maternal knowledge.
- Infant factors such as birth weight, gestational age, gender, and feeding method.
- Breastfed infants with poor positioning, latch and/or milk transfer.

WIC staff should identify and address any potential underlying feeding issues causing newborn weight loss (21). An infant with a weight loss of greater or equal to seven percent signals the need for careful evaluation and intervention, infants with a weight loss of ten percent or more is a marker for a medical referral (22).

Any Weight Loss 2 Weeks to 6 Months

While the 2006 CDC/WHO growth charts show slower growth from 3 – 18 months of age as a normal growth pattern, weight loss is not expected beyond the first two weeks of life and requires follow-up (23). After birth, growth faltering is caused by inadequate caloric intake, normal caloric intake in an environment of excessive loss or malabsorption; or increased metabolic needs. In cases of dehydration or acute illnesses like gastroenteritis, fluid loss that exceeds fluid intake may also lead to significant weight loss. Weight loss in young infants is commonly caused by acute infections, feeding problems, allergy to milk protein, lead poisoning, HIV, malnutrition, pyloric stenosis, gastrointestinal reflux, celiac disease, cystic fibrosis, neglect, growth failure, congenital heart disease, and inborn errors of metabolism.

The primary goal of the intervention is to enhance infant health outcomes by addressing causes of slowed growth and keeping vulnerable infants tracking along growth percentiles established in infancy. In some cases, it may be important to intervene quickly, while in other cases a period of frequent growth monitoring would be more appropriate to prevent too rapid refeeding and subsequent increased risk of type 2 diabetes, obesity, and cardiovascular disease later in life (24, 25).

If faltering growth is suspected, maternal neglect and inadequate caloric intake due to inappropriate formula mixing, breastfeeding problems, early introduction of solid food, maternal depression, and emotional deprivation, must be ruled out and addressed (6). Growth monitoring should occur on a monthly basis – utilizing two separate weight measurements taken at least eight weeks apart as data markers. It is imperative that WIC staff involved in measuring infant growth use standardized equipment and receive adequate training prior to conducting infant measurements to increase reliability between measures (26). If the participant does not respond to nutritional management (i.e. weight continues to falter) or if other

markers falter (such as length for age or stagnant head circumference), then the infant should be referred to their health care provider for assessment.

Normal Growth Patterns

Understanding normal growth patterns in infants is important. The pattern of weight gain during infancy varies depending on the method of feeding. Compared to formula-fed infants, breastfed infants gain weight rapidly in the first three to four months of life and relatively slowly thereafter. Although the weights of formula-fed and breastfed infants are similar by one to two years of age, the typical pattern of slowed weight gain after three to four months among breastfed infants may lead to unnecessary early introduction of solid foods or cessation of breastfeeding if the slowed weight gain is perceived as lactational inadequacy. (27, 28, 29)

The table below shows the average mean values for weight gain for healthy exclusively breastfed infants:

Average Of Mean Values for Gains in Weight for Healthy Exclusively Breastfed Infants (30)

Interval (mo)	Girls (g/day)	Boys (g/day)
0-1	30	33
1-2	28	34
2-3	22	23
3-4	19	20
4-5	15	16
5-6	13	14
6-7	12	11

Screening for Slow or Faltering Growth Patterns

Screening for slow or faltering growth patterns is a preventive health measure which requires careful growth monitoring and critical thinking skills. And while a single measure of weight-for-age may be cause for concern, it cannot be interpreted to show growth faltering. No single measurement on its own is adequate for identifying nutritional growth delay (31). As stated earlier, it is imperative that WIC staff involved in measuring infant growth use standardized equipment and receive adequate training prior to conducting infant measurements to increase reliability between measures (26).

Growth faltering is a reflection of two weight measures, preferably eight weeks (two months) apart, to calculate an increment in growth. It is possible to use four week (one month) intervals for the assessment of slow growth patterns, but since there may be errors in clinical measurement, it is more prudent to use eight weeks as the minimum time interval between measurements. Infant weight will fluctuate over the course of the day and length growth may occur in discrete periods lasting no more than 24 hours separated by growth-free intervals lasting as long as two months. Thus, growth that seems abnormal may be nothing more than a growth-free period in a child's life (10).

Screening for early growth failure should be done using multiple growth indicators, including risks for underweight (Risk #103), short stature (Risk #121), failure to thrive (Risk #134) and low head circumference (Risk #152) to allow for timely remedial interventions and prevention of further growth failure.

In summary, a three-step approach should be considered for evaluation of infants with suspected abnormal growth. First, growth data should be assessed for accuracy. Second, feeding problems, improper formula preparation, etc. should be assessed to determine if calorie intake is insufficient for growth and development. Third, the infant should be assessed for other medical conditions or developmental delay.

Implications for WIC Services

In most situations, growth may not simply be a factor of undernutrition, but rather a combination of environmental and other factors which will require a broad intervention strategy for successful health outcomes (32). In general, intervention strategies may include screening for environmental health factors such as (25, 32):

- Adequate nutrition and nutrient dense foods, including a history of human milk or formula feeding.
- Appropriate introduction of complementary foods.
- Maternal conditions that impact lactation performance: mastitis, prolonged labor, C-Section, hypo or hyperthyroidism, Diabetes, low birth weight infant, pregravid BMI >27, pregnancy-induced hypertension, flat/inverted nipples, vitamin B12 deficiency.
- Meal time routine and eating/feeding behavior.
- Growth faltering in light of familial growth patterns.
- Neglect.
- Lack of social support.
- Adverse social and psychological environment.
- Depressed or poor mental abilities of parent/caregiver. It may manifest as dressing inappropriately for the weather; looking disheveled and lacking in hygiene; or making inappropriate faces or reactions like laughing.
- Lack of parental education and nutrition knowledge.

Nutrition counseling for this risk would ideally be provided by staff with specialized education and training to assess growth parameters and identify causative factors accurately. Intervention strategies to address this criterion include:

- Appropriate timing and type of participant intervention.
- Effective participant-centered nutrition counseling.
- Early postpartum breastfeeding support to minimize risk of dehydration and/or failure to thrive.
- Review of baby behavior hunger and satiety cues. (For more information see WIC Baby Behavior Basics, WIC Online Learning Module available on the WIC Works Resource System: [https://wicworks.fns.usda.gov/wic-learning-online.](https://wicworks.fns.usda.gov/wic-learning-online))
- Review/adjustment to breastfeeding/formula feeding schedule.
- Review/adjustment of formula mixing technique.

- Referral to lactation specialist for latch and position assistance.
- Tailored food package prescription.
- Review accuracy of weight, length, and head circumference measurements.

Referral to allied health professionals such as: physician, early childhood intervention, social services, and home visiting program.

A variety of intervention strategies can help infants establish and maintain individual growth patterns. The desired outcome is one where the infant's own growth curve tracks within the channel established in early infancy. Also, because growth monitoring is an intervention that happens largely after the fact, there may be benefit to anticipatory guidance that provides prevention rather than crisis management of this problem (33). It is suggested that when feeding is going well, the baby will eat as much as she needs and grow in the way that is right for her if parents maintain a division of responsibility in feeding (34).

References

1. American Academy of Pediatrics. Policy Statement. Breastfeeding and the use of human milk. *Ped*. 2005; 115(2):496-506.
2. Academy of Breastfeeding Medicine. Clinical Protocol #3. Hospital guidelines for the use for supplementary feedings in the healthy term breastfed neonate. 2009;(4):175-82.
3. Grummer-Strawn L, Reinhold C, Krebs N. Use of World Health Organization and CDC growth charts for children aged 0-59 months in the United States. *CDC Recommendations and Reports* September 10, 2010;59(rr09):1-15.
4. Wacogne, S. Weight faltering and failure to thrive in infancy and childhood. *BMJ*, 345:e5931.
5. Beker J. Principles of growth assessment. *Pediatrics in Review* 2006;27:196-198.
6. Kessler D. Growth assessment and growth failure: Overview and the role of nutrition. *Pediatric Perspectives* 2007;4(1); 1-4.
7. Lampl M, Velhies JD, Johnson ML. Saltation and stasis: A model of human growth. *Science* 1992; 258:801-803.
8. Lampl, M, Johnson, ML, Emmett, PM, et al. Mixed distribution analysis identifies saltation and stasis growth. *Ann Hum Biol* 2001;28:403.
9. Mei, Z. Shifts in percentiles of growth during early childhood: analysis of longitudinal data from the California Child Health and Development Study. *Pediatrics* 2004;133(6):617-27.
10. Glander L, Karlberg J, Albertsson-Wikland K. Seasonality in lower leg length velocity in prepubertal children. *Acta Paediatr* 1994;83:1249.
11. Legler J, Rose L. Assessment of abnormal growth curves. *Am Fam Phys* 1998: (1)153-58.
12. Cameron N, Preece MA. Catch-up growth or regression to the mean? Recovery from stunting revisited. *Am J Hum Biol* 2005;17:412-7.
13. Victora CG, Adair L, Fall C, et al. Maternal and child undernutrition: consequences for adult health and human capital. *Lancet*. 2008;371:340-357,.
14. De Onis, Mercedes, et al. Worldwide implementation of the WHO Child Organization growth standards. *Public Health Nutrition* 2012;1-8.
15. Flaherman VJ, Schafer EW, Kuzniewicz MW, Li SX, Walsh EM, Paul IM. Key weight loss nomograms for exclusively breastfed newborns. *Ped* . 2015;135(1)e16-23.

16. Martens PJ, Romph, L. Factors associated with newborn in-hospital weight loss: comparisons by feeding method, demographics, and birthing procedures. *J Hum Lact* 2007;23:233.
17. Wright CM, Parkinson KN. Postnatal weight loss in term infants: what is normal and do growth charts allow for it? *Arch Dis Child Fetal Neonatal Ed.* 2004;89:f254-257.
18. Gahagan, S. Failure to thrive: a consequence of undernutrition. *Pediatrics in Review* 2006;27:1-11.
19. Kirkland R, Motil K. Failure to thrive (undernutrition) in children younger than two years. *Up To Date* 2014 (August).
20. Reilev M, Borch K, Pryds OA. Neonatal hypernatramic dehydration-why increasing incidence? *Ugeskr Laiger.* 2007;169:1227-31.
21. Livingston, V. Failure to thrive while breastfeeding. *Breastfeeding Medicine* Vol 1, No. 2, 2006.
22. Lawrence RA, Lawrence, RM. *Breastfeeding: a guide for the medical profession.* 6th Edition, St. Louis, MO: Elsevier Mosby. 2005.
23. Grummer-Strawn L. Response letter to Patricia Daniels 2008 risk criterion #135 questions. Centers for Disease Control and Prevention. October 11, 2008.
24. Eriksson JG, et al. Catch-up growth in childhood and death from coronary heart disease: longitudinal study. *BMJ* 1999; 318:427-31. Later 2001 reference entitled, early growth and coronary heart disease in later study by JG Eriksson et al, *BMJ*, Apr 21, 2001; 322(7292);949-953.
25. Hales CN; Ozanne SE. The dangerous road of catch-up growth. *J Physiol* 2003;547:5-10.
26. World Health Organization. *Physical status: The use and interpretation of anthropometry.* Report of a WHO Expert Committee. WHO Technical Report Series no. 854. Geneva: WHO (1995).
27. Mei Z, et al. Comparison of prevalence of shortness, underweight, and overweight among US children aged 0-59 months by using the CDC 2000 and the WHO 2006 growth charts. *J Pediatr.* 2008;153:622.
28. Van Dijk, et al. Growth-curve standards and the assessment of early excess weight gain in infancy. *Pediatrics* 2009; 123:102.
29. Whitehead RG. The importance of diet-specific growth charts. *Acta Paediatr* 2003; 92:137.
30. The American College of Obstetricians and Gynecologists, American academy of Pediatrics. *Breastfeeding Handbook for Physicians.* 2nd e. 2014. ACOG, Washington DC; AAP Elk Grove, IL.
31. Kessler D, et al. Failure to thrive: the prevalence and concurrence of anthropometric criteria in a general infant population. *Archives of Disease in Childhood.* 2007 Feb; 92(2):109-114.
32. Barker DJ. The developmental origins of adult disease. *Eur J Epidemiol* 2003;18:733-6.
33. Shrimpton R, et al. Worldwide timing of growth faltering: implications for nutritional interventions. *Pediatrics* 2001;107:e75.
34. American Academy of Pediatrics. *Bright Futures Nutrition.* 3rd ed. 2011.