Growth tracking to identify and intervene in growth faltering

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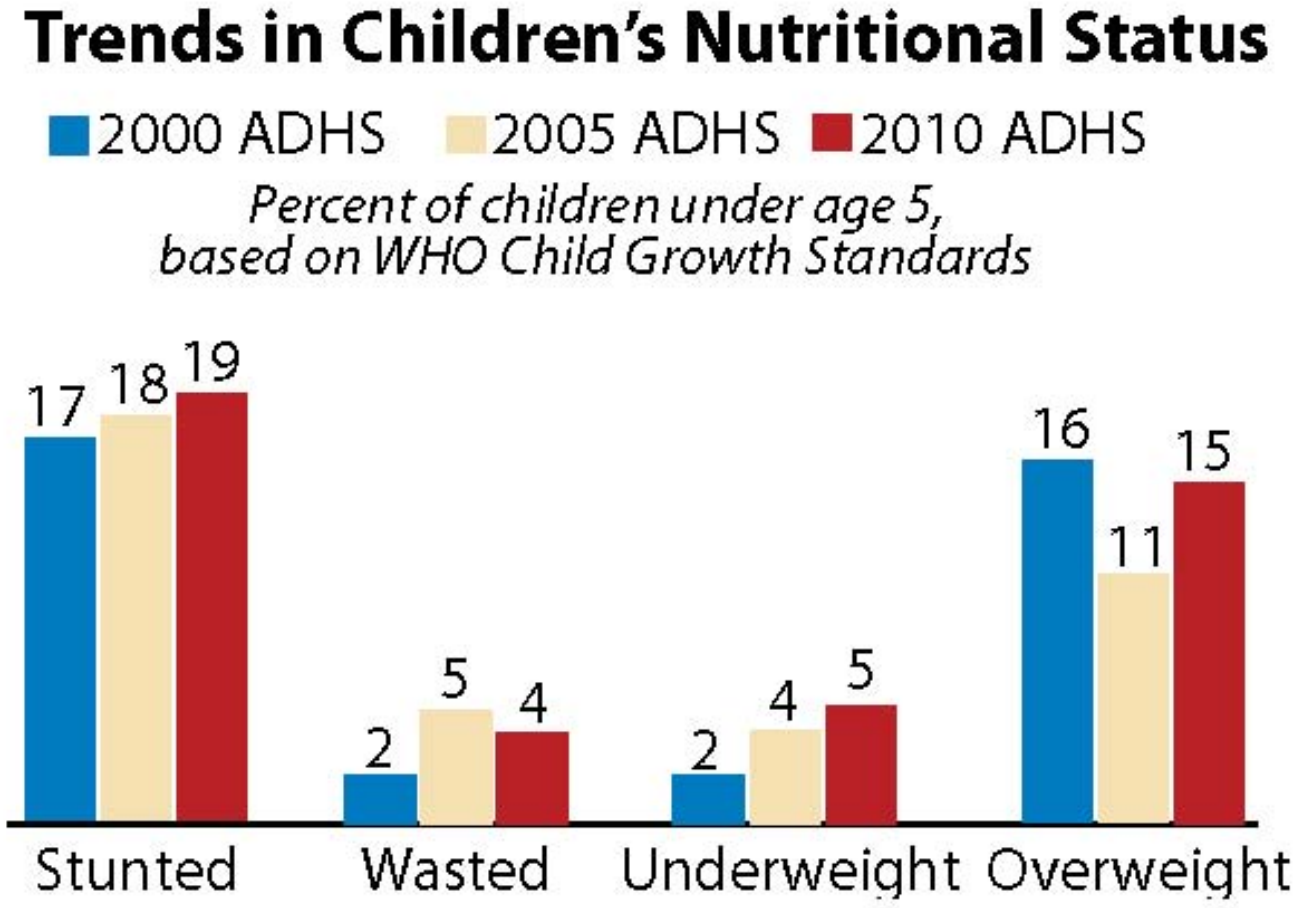
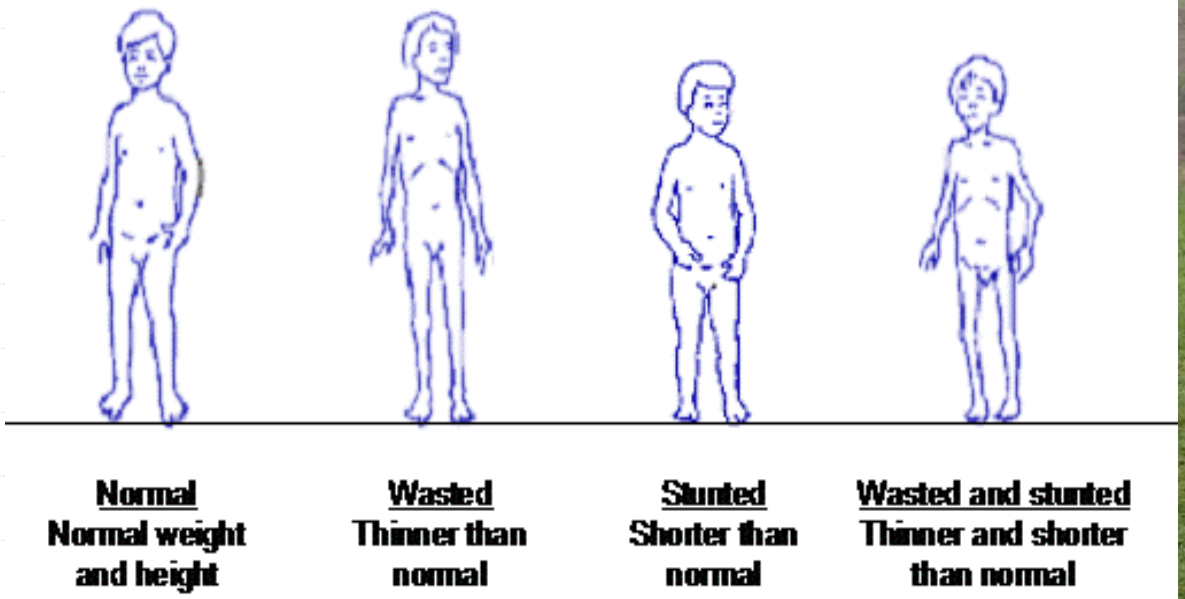
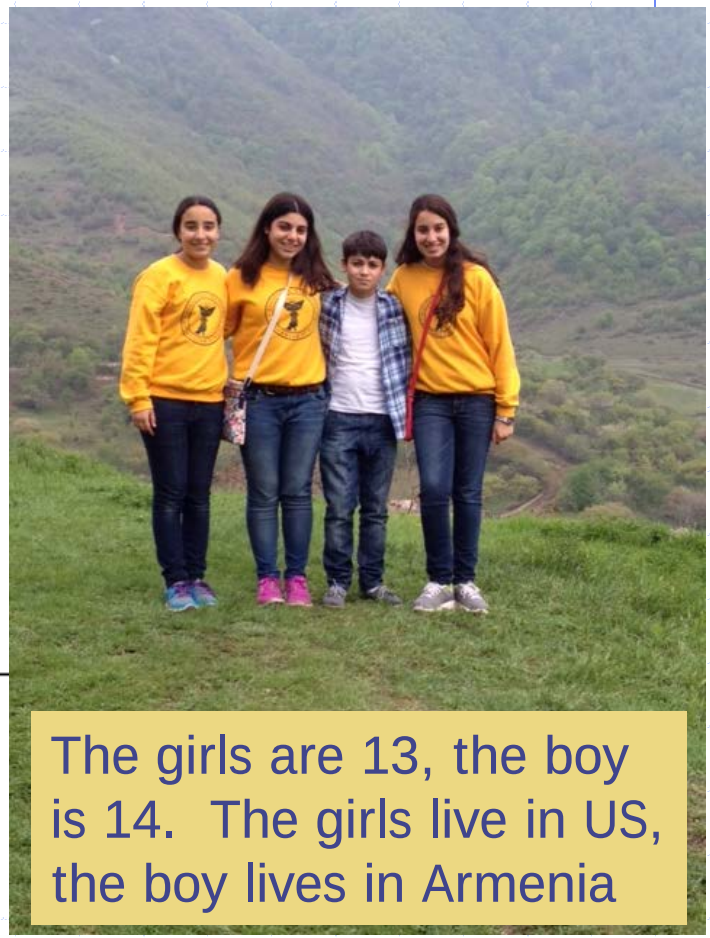
Problems with growth—under/over nutrition in Armenia



National Statistical Service, Ministry of Health [Republic of Armenia], and ICF International 2012. 2010 Armenia Demographic and Health Survey: Key Findings. Yerevan, Armenia and Calverton, Maryland, USA: National Statistical Service, Ministry of Health and ICF International.

Definitions of growth faltering





The girls are 13, the boy is 14. The girls live in US, the boy lives in Armenia

- Wasting (Acute malnutrition)
  - Reduced weight relative to median weight predicted by height
- Stunting (Chronic malnutrition)
  - Reduced height relative to median height predicted by weigh

Evaluating and tracking growth

Key point: plot growth on a chart over time to look for abnormalities

Growth reference: CDC 2000 charts

- Followed growth of infants born between 1975 to 1994 (NHANES I-III)
- No assessment of what is normal in optimal growth environment
- Majority of infants were fed formula (only 33% reported some breastfeeding at 3 mo) and most were Caucasian
- Clinical utility—tracking patient growth over time
- American Academy of Pediatrics (AAP) still recommends using CDC charts for children >2 y

https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5909a1.htm (downloaded May 29, 2016)

WHO 2006 charts—Growth standard

- Created to measure optimal growth in nutritionally optimal environment applicable world-wide
- Data from: Brazil, Ghana, India, Norway, Oman, USA
- Stringent inclusion and exclusion criteria
  - Longitudinal data for from birth to 2 years old
  - 0-2 y, 50% of 1743 patients completed the study
  - Predominantly breastfed at least until 1 year old
  - Complementary foods started between 4-6 mo
  - High SES, stable population, had to live at altitude <1500 meters

Ziegler E. Curr Opin Nutr Metab Care. 2012;15:298-302

Differences between CDC 2000 and WHO charts

- WHO charts have the 2nd and 98th percentile—denotes 2 SD from median, useful to identify failure to thrive
- Steeper rise in weight from 0 to 3 month in WHO charts
  - Due to more breastfed babies
  - More infants will be identified as underweight compared to CDC 2000 charts
- Slower rise 3 to 12 months
  - Fewer underweight babies compared to CDC 2000
- Minimal differences in length for age
- Either chart will work fine in clinical practice

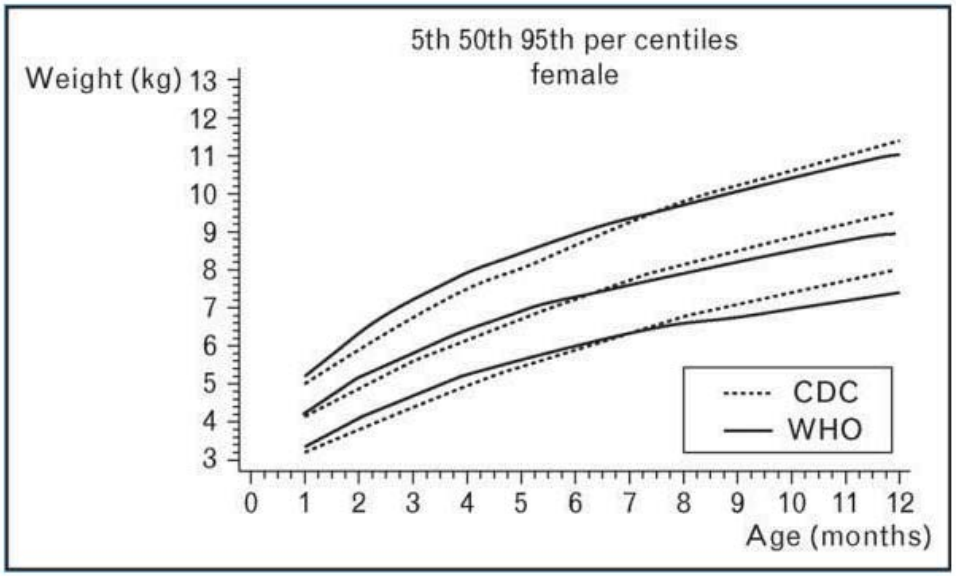


FIGURE 1. Weight-for-age percentiles (5th, 50th, 95th), female infants 0-12 months, WHO standards (WHO) and CDC

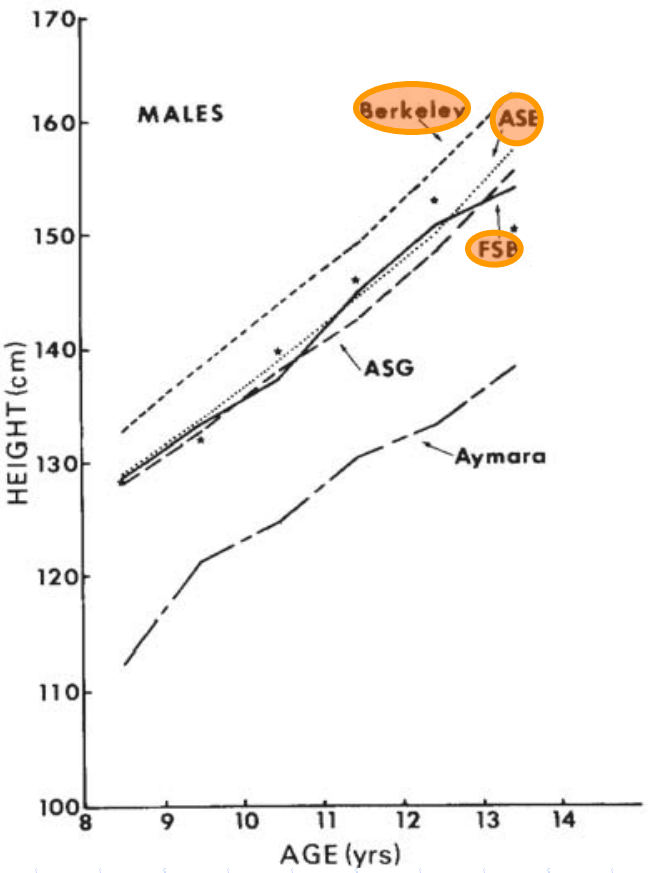
Duggan M. Annals of Tropical Pediatrics. 2010;30:1-17; Ziegler. Curr Opin Clin Nutr Metab Care. 2012;15:298–302; AAP. Pediatric nutrition, 7th ed. 2013 p. 619

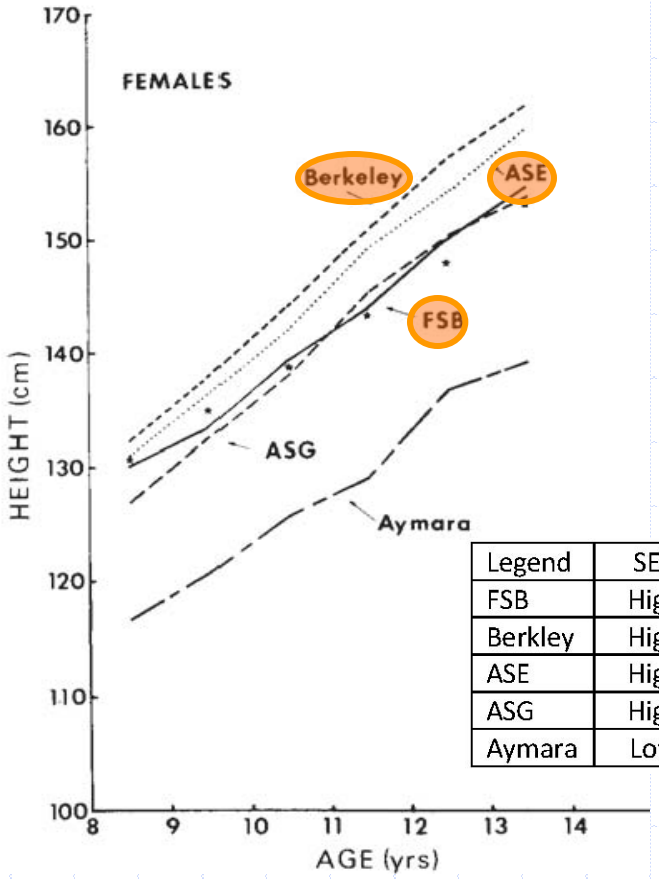
Does birth and growth at high altitude result in short stature?

- WHO growth standard sample excluded children growing at altitude >1500 m
- What is the altitude of where people live in Armenia:
  - 50% <1000 m
  - 25% 1000-2000 m
  - 25% >2000m
- Is high altitude associated with short stature (rather than poor nutrition, low SES and genetics?
- Denver, Colorado: 1610 m: no difference in growth
- Bolivia study evaluated SES, altitude and ethnicity on height
  - La Paz, Bolivia—3200-4000 m
  - Guatemala City, Guatemala—1493 m
  - Berkeley, CA, USA—sea level

Stills C. Personal communication. 2016; Am J Phys Antrop. Stinson S. 1982;59:61-71

SES, altitude, ethnicity and height





Legend	SES	Altitude	Ethnicity
FSB	High	High	European/Bolivia
Berkley	High	Low	USA/European
ASE	High	Low	European/Guatemala
ASG	High	Low	Indigenous/Guatemala
Aymara	Low	Low	Indigenous/Bolivia

- Difference between children attending French school in Bolivia who were born and lived all life in Bolivia vs <25%: 4 cm
- Most of height difference due to SES

Stinson S. Am J Phys Antrop. 1982;59:61-71

Problems with use of growth charts

- Difficult to measure length and height
- Problems with plotting on the growth chart
- Dr. Hovhannisyan showed that 91% of 570 charts reviewed had growth plotted, but many mistakes were made
- Clinic 5 performed significantly better than clinic 1-4

Proportion of properly plotted growth

Growth parameter	Clinic		Total
	1-4	5	
Weight for age (%)	44-57	98	61
Height for age (%)	41-56	98	60
Weight for Height (%)	14-33	53	27

Adapted from Hovhannisyan L

Hovhannisyan L. AUA Masters Thesis 2011. Hovhannisyan. Public Health Nutrition 2013;17:1046-53

Possible solutions...

- Better staff training—one clinic did much better than others
- Computerized plotting—available for excel
- Physicians should recheck growth and replot if graph looks inacurate

Identification of growth faltering

Failure to thrive (FTT) and problems with using growth charts for diagnosis

- Definitions
  - Major percentile lines: 5, 10, 25, 50, 75, 90, 95
  - Failure to thrive
    1. Deceleration of weight across 2 major percentile lines on more than 1 consecutive occasion
    2. Weight for age below the 3rd or 5th percentile on weight for age curve
- Problems with FTT definition
  - Difficult to assess on the first visit
  - Does not include symmetric (height, weight and head circumference) vs asymmetric drop off
  - Non FTT children may cross percentiles to adjust to predetermined growth post intrauterine environment

Jaffe A. Pediatrics in Review. 2011;32:100-7

Frequency of crossing 2 major percentiles in healthy US children (n=18,085, born between 1959 and 1967)

- Catch-down growth—large newborn of mother with gestational diabetes
- Catch-up growth—small newborn of mother with placental insufficiency

Age (mo)	Growth parameter (%)		
	Height for age	Weight for age	Weight for Height
0-6	32	30	62
6-12	15	15	27
12-18	16	7	21
18-24	14	6	21

Mei Z. Pediatrics. 2004;113:e617

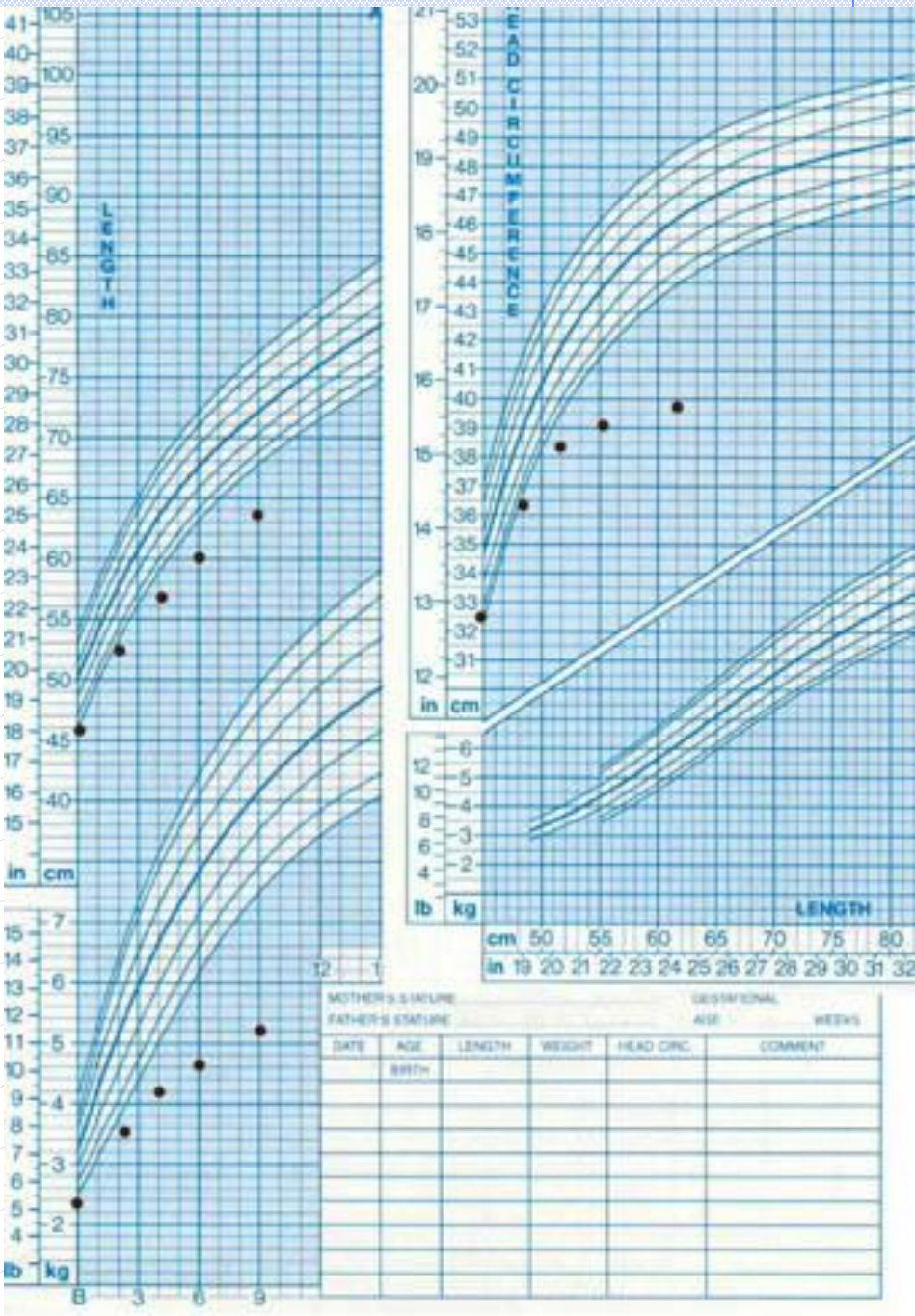
Growth faltering cases

Bottom line:

1. Measure growth accurately
2. Plot growth accurately at every visit

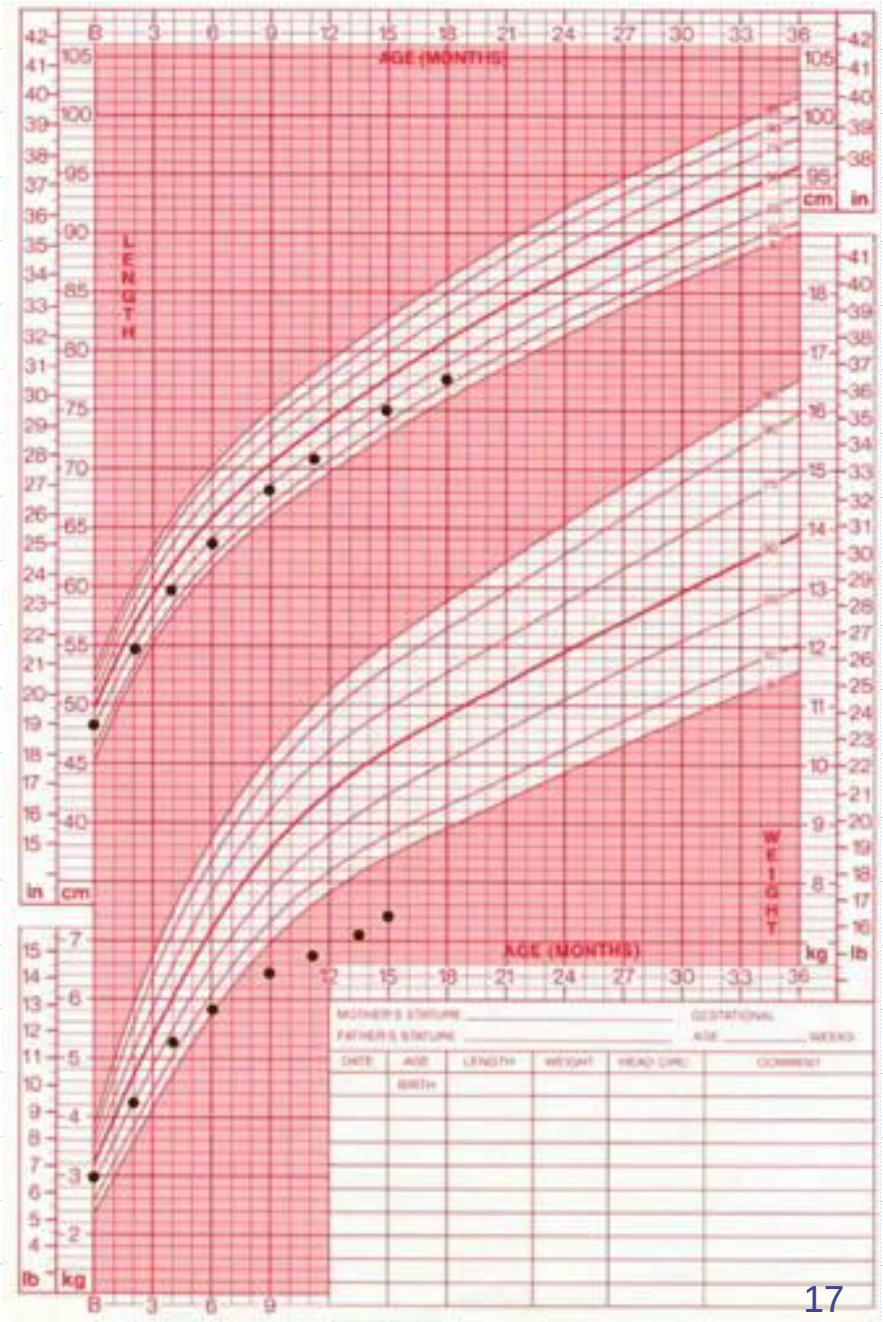
Case 1

- Full term boy born to 37 y healthy woman, low birth weight, (hypotonia) and poor feeding. Pt noted to have widely set eyes (hypertelorism), low-set ears, a small jaw, and a rounded face.



Case 2

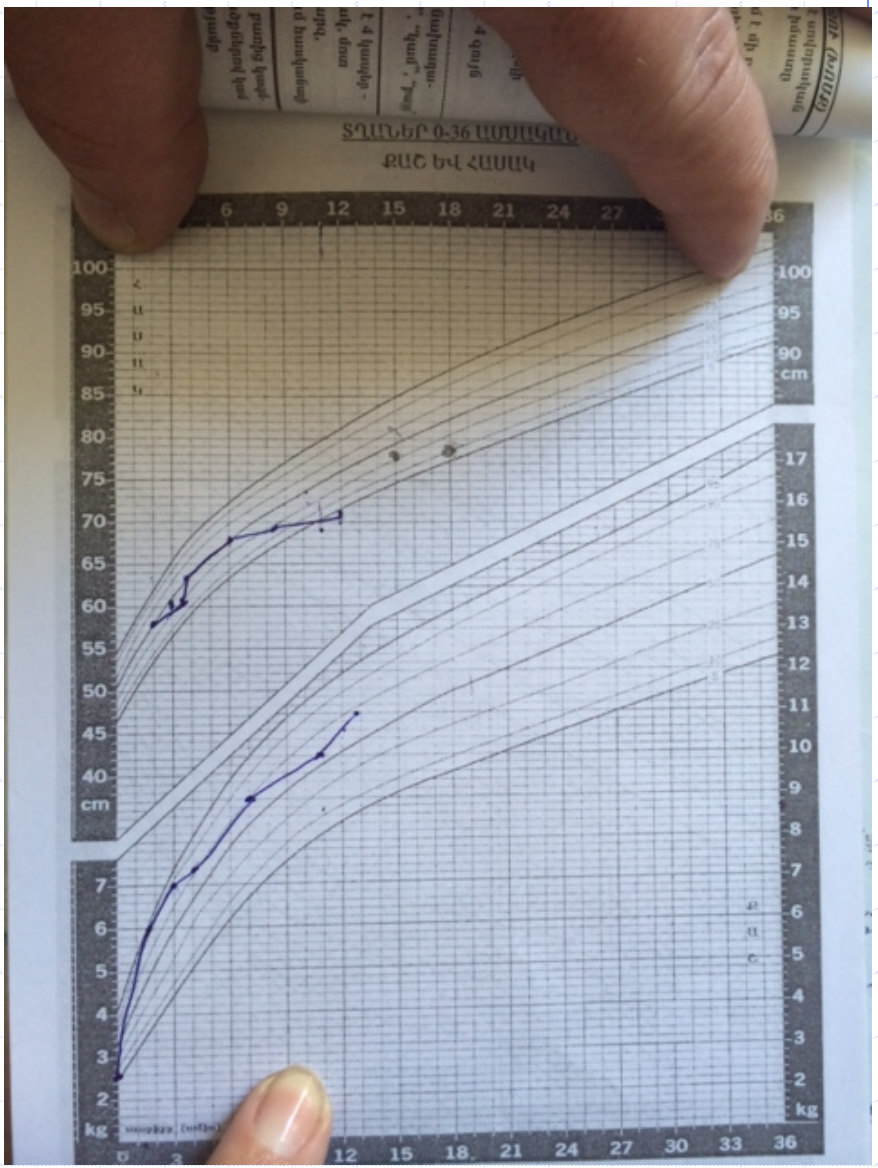
Full term Boy, born 3000g, height 48.5. Mixed fed since 2 months of age. Bad social economic conditions. Parents are average size.



Case 3

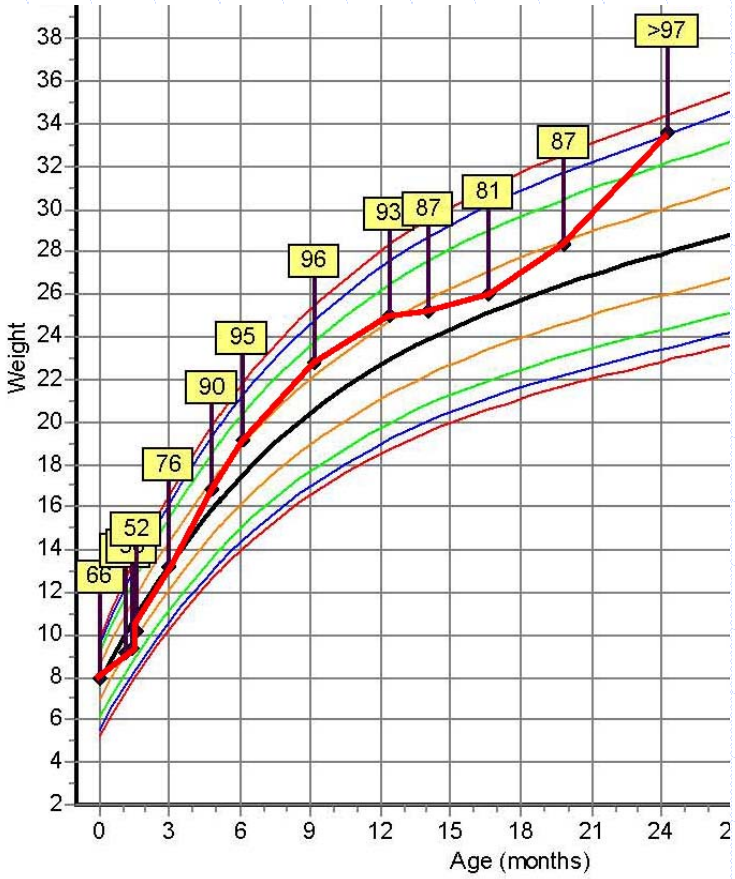
Stunting

Chart reviewed. No history available

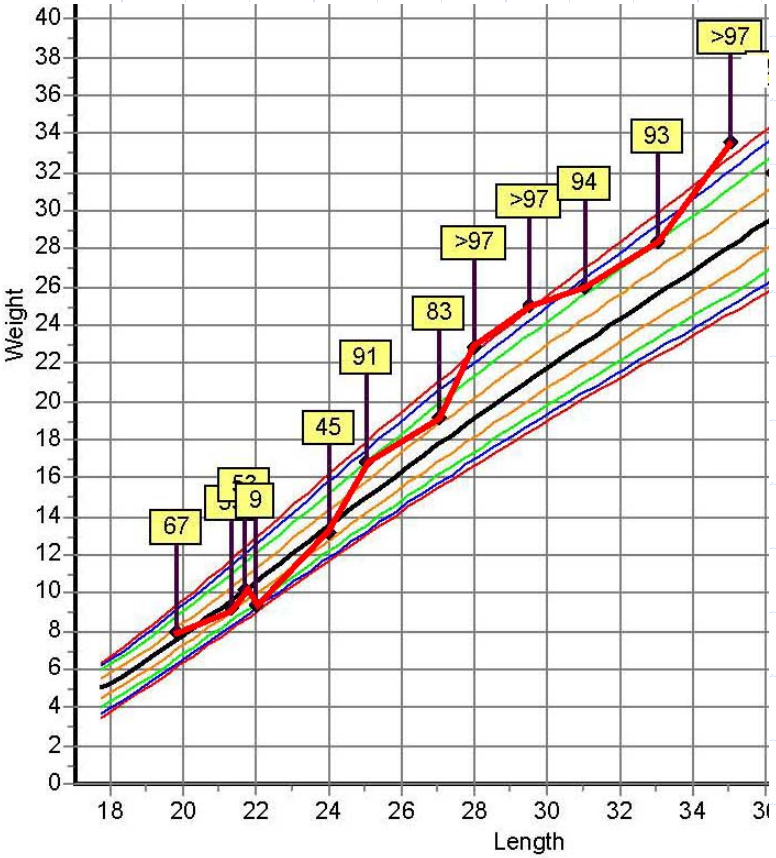


Case 4: 2 yr old with abnormal growth

Weight

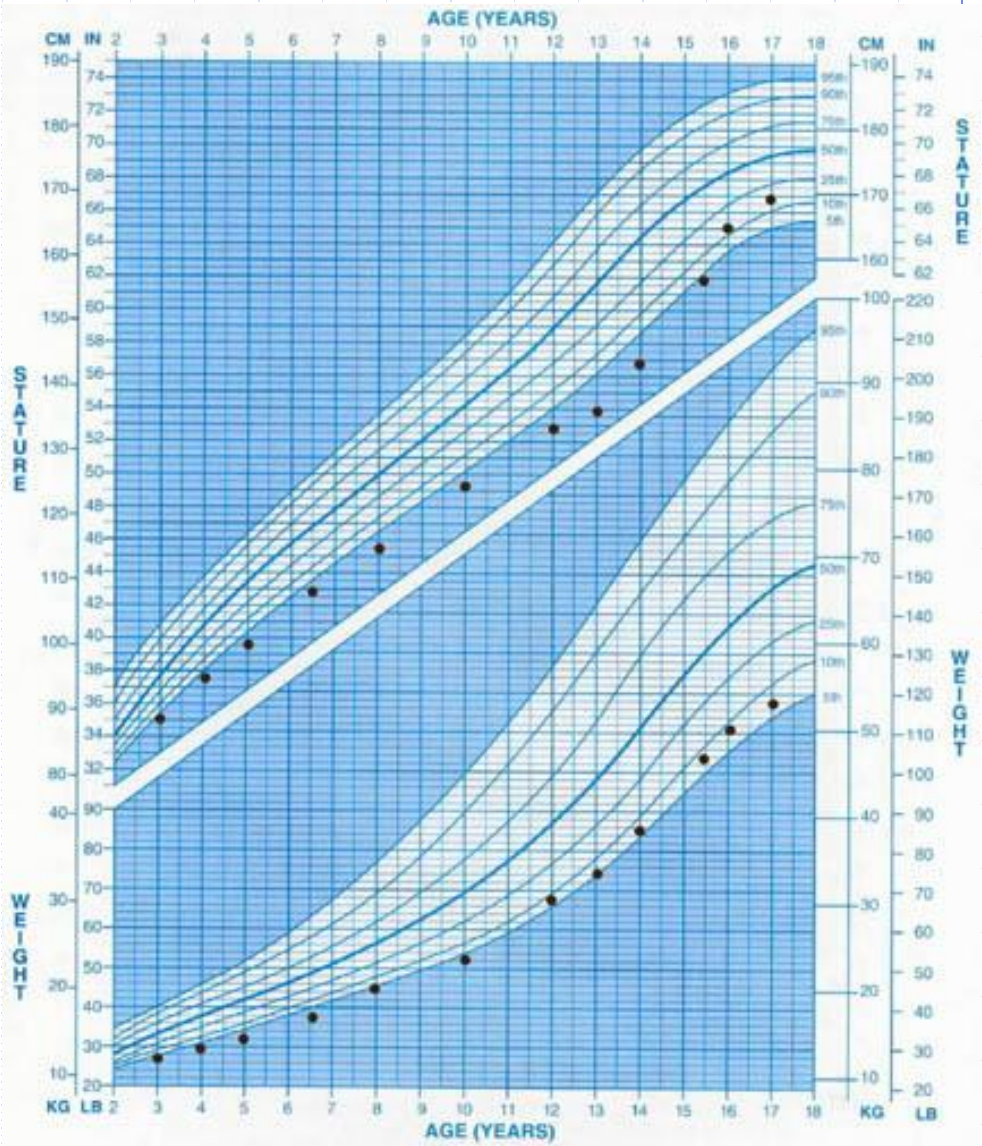


Weight for Length



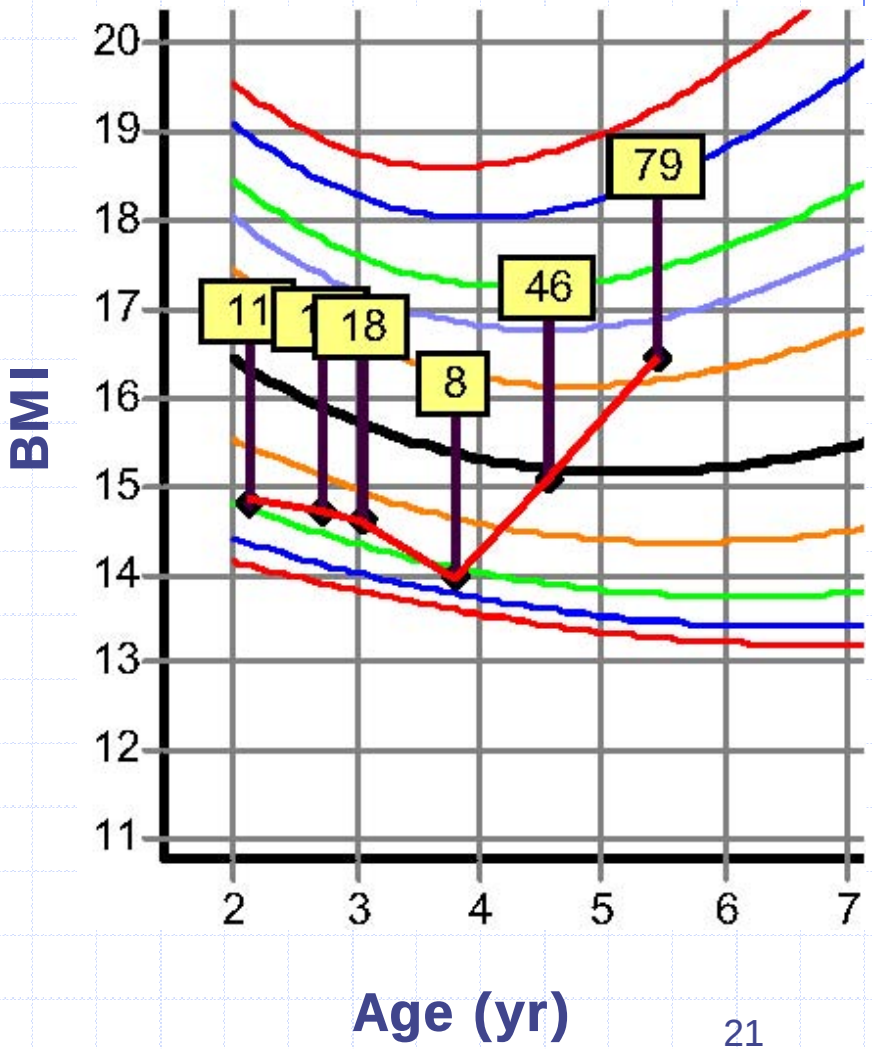
Case 4

Girl born FT, 2800g, height 45 cm. Breast fed exclusively until three months. 1st seen in current office at 3 yrs old, healthy and developing normally. Growth as below. Both parents are at 15% for height.



Patient: Healthy African-American girl

- BMI between 8th and 18th percentile from 2 to 4 years old
- Gained 71% in BMI over 1.5 years



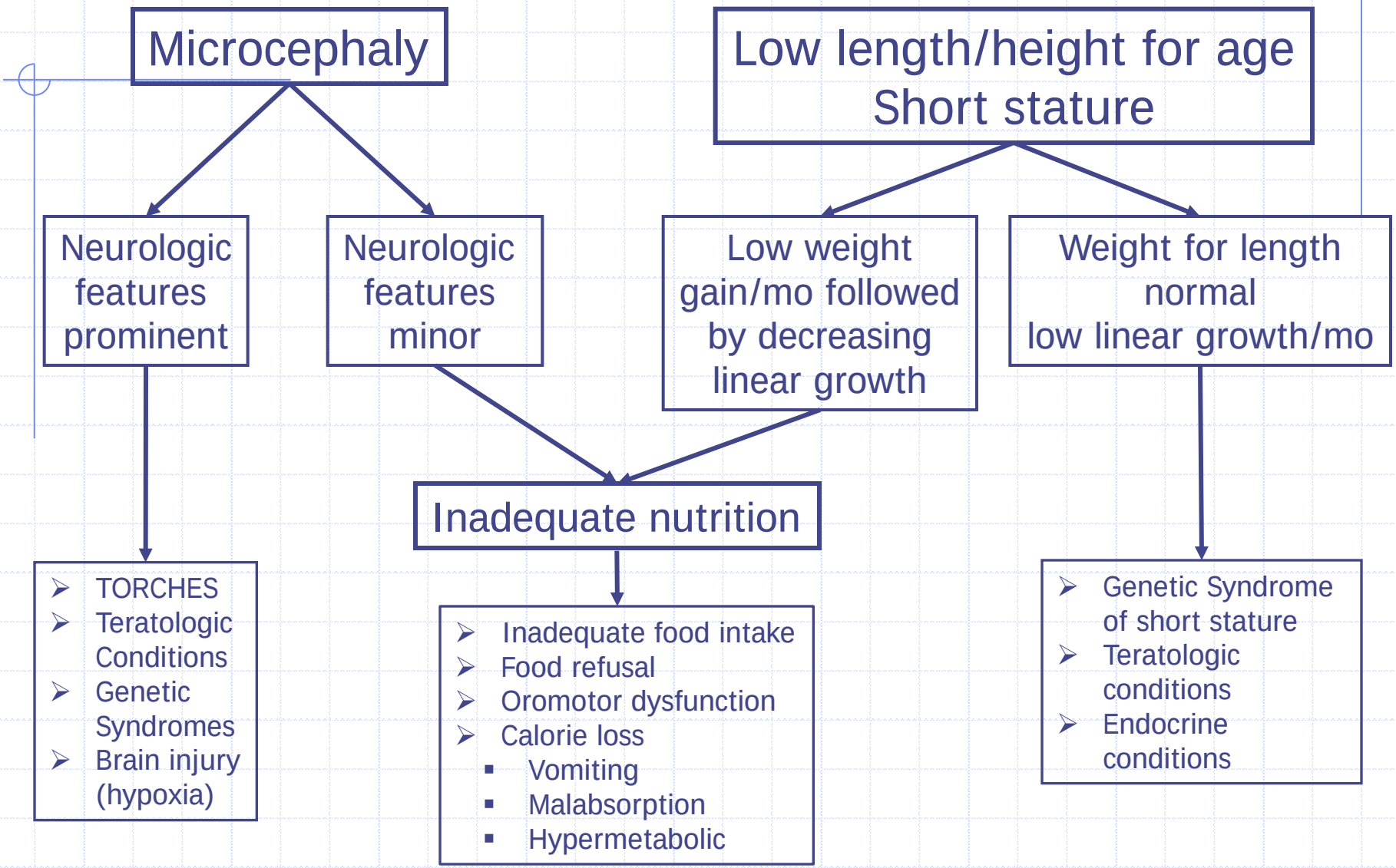
Learning objectives for breakout session

- Review nutritional needs of children 0-5 years old
- Review approach to identification and treatment of children with growth faltering
- Discussion

Conclusion

- Growth tracking is key to early identification and treatment of growth faltering and overweight
- WHO 2006 or CDC charts can be used to identify growth problems because of only small differences between charts
- WHO 2006 growth standard can be applied to Armenian children
- Patients may benefit from electronic plotting of growth

Growth charts guide diagnosis of FTT



Gahagan S. Pediatr in review. 2006;27:e1-11