

Growth - What's Normal and What's Not?

By

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What is the growth chart?

The most valuable tool for assessing a child's growth is the growth chart. A child's height and weight should be measured and marked on his or her growth chart at every doctor's visit. This is particularly important during the first 3 years of life, when height, weight and head circumference should be done at least every 6 months. After 3 years of age, height and weight should be checked yearly and plotted on the chart.

The most widely used growth charts are based on health data collected on American children since the 1960s. These charts were revised in 2000 and can be downloaded from the internet (www.cdc.gov/growthcharts). The heights and weights of boys and girls are broken into centiles or percentages represented on the chart by curved lines marked at the 5th, 10th, 25th, 50th, 75th, 90th and 95th percentile. Age is marked in years or months along the bottom of the chart. Height and weight are marked along the sides. The 50th percentile is the average height for any given age. Thus, a growth chart tells us how a child's height and weight compare to those of other children of the same age and gender. A child whose height is at the 25th percentile is taller than 25% of "normal" children her age. Similarly, a child whose weight is below the 5th percentile weighs less than 95% of "normal" children her age. It is important to remember however, that by definition, 5% of normal children will fall below the 5th percentile. Therefore, not everyone who falls below the 5th percentile has a growth problem and requires investigation.

Although these charts are based on the "normal" American population, they don't account for specific racial differences. Chinese growth charts are also available (<http://catalog.com/cgi-bin/var/fwcfc/growthchart.html>). However, these charts are based on measurements taken in the early 1960s of ethnic Chinese children living in Hong Kong, most of whom had emigrated from Guangdong Province. Although the stereotype is that all Chinese people are small, this is clearly not the case and the average height varies significantly from province to province and between the different ethnic minorities.

Therefore, in assessing an Asian child's height and weight, it is best to start with the North American growth charts. From plotting the child's measurements, we determine the child's height and weight percentile. If these are on the North American chart (ie above the 5th percentile), then it is appropriate to continue using the North American charts. If the child's height and/or weight are significantly below the curve (less than the 5th percentile), it may be more appropriate to use the Asian charts for this child.

Is your child small for height, weight or both?

If the child's height and weight percentile are both low (beneath the 5th percentile) and are approximately the same amount below the curve, then this is primarily a growth problem. Alternatively, if the weight percentile is well below the height percentile, we are dealing with a

primary weight problem (also known as failure to thrive). However, a weight problem, untreated, will also become a height problem over time as a child who is failing to gain weight appropriately will not be able to grow normally.

A primary weight problem may be due to poor intake, problems absorbing food, and/or increased metabolism due to another illness (e.g. chronic kidney disease). Investigations for a weight problem may include blood, urine and stool samples as well as referrals to a dietitian. Many children who are adopted internationally are underweight upon arrival back in Canada. The cause is usually undernutrition (not enough food) and quickly corrects after the child starts receiving the right amounts and types of food for age. If some catchup weight gain is not seen within 3 months, it is probably appropriate to initiate some tests, particularly looking for signs of chronic infection such as parasitic infections and TB.

If the primary concern is with height, then two questions must be answered. First, is the child's height appropriate for the genetic potential, and secondly, is the rate of growth normal? For children adopted internationally, where little or nothing is known about the biological parents, it may be impossible to answer the first question. The second question can only be answered over time after a period of observation.

Is your child's height appropriate based on the genetic potential?

If your child was adopted from Vietnam or Korea, you may have some details about the biological parents. If you know their heights, you can determine your child's genetic height potential. The mid-parental height, or genetic potential is calculated as follows:

$$\text{Genetic potential for a boy} = \frac{\text{mother's height (in inches)} + \text{father's height (in inches)} + 5 \text{ inches}}{2}$$

$$\text{Genetic potential for a girl} = \frac{\text{mother's height (in inches)} + \text{father's height (in inches)} - 5 \text{ inches}}{2}$$

All other things being equal, this is usually accurate within 3 inches (in either direction). For example, if the biological mother is 5'1" and the biological father is 5'8", then the midparental height or genetic potential for their daughter is 62" $((61" + 68" - 5")/2)$. If we plot this height on a growth chart, it tells us that we can expect the daughter of these biological parents to end up with a final adult height around the 25th percentile. This child should also be growing along the 25th percentile during childhood.

Is your child's growth rate normal?

Far more important than a child's absolute height, is his or her growth rate. Growth is most rapid during the first year of life and slows down thereafter (Table)

Table: Normal Growth Rates During Childhood

<i>Age</i>	<i>Growth Rate per Year</i>
birth to 1 year	7 to 10 inches (18 to 25 cm)
1 to 2 years	4 to 5 inches (10 to 13 cm)
2 years to puberty	2 to 2 ½ inches (5 to 6 cm)
pubertal growth spurt	
boys	2 ½ to 4 ½ inches (6 to 11 cm)
girls	2 ½ to 4 ½ inches (6 to 11 cm)

boys

3 to 5 inches (7 to 13 cm)

If a child is growing at a normal rate, he or she will continue to “track along the same percentile”. This is usually reassuring and essentially rules out a growth problem which requires treatment. However, it also means that a child who is small as a child but growing at a normal rate, is likely to remain small as an adult. A common exception to this rule is the “late bloomer” (see below). However, if a child is growing at a rate below normal, then that child will cross percentiles downwards (e.g. from the 25th to the 10th percentile, or falling further below the 5th percentile). This always requires further assessment and likely investigation to determine the cause and any necessary treatment.

There are a number of reasons why children may have slow growth and cross percentiles downwards. If the weight is relatively protected and is staying on the same percentile or no worse than the height, then an endocrine (hormonal) problem should be considered. Examples of this include hypothyroidism (underactive thyroid) and growth hormone deficiency. If the weight is more affected than the height, it is more likely to be due to another kind of medical problem such as poor dietary intake, malabsorption, chronic infection, kidney disease.

The value of a bone age

A bone age (x-ray of the wrist) is frequently done when a child has a growth problem. The bones in the hand and wrist are compared to well established standards and provide a measure of the remaining growth potential for that child. When a child is small, a delayed bone age is good as this means the child has more growth potential than other children that age. However, for a bone age to be interpreted correctly, we must be certain about the child’s age and this is not always known for children adopted internationally, especially from China. Some people have suggested getting a bone age to help determine the child’s true chronologic age. However, normal children can have a delayed bone age. In addition, the normal variability in bone ages means that the bone age can only be reported within a certain number of months (e.g. bone age is read as 12 months but could be as young as 7 months or as old as 17 months). As a result, bone ages cannot be reliably used to determine a child’s true age, particularly in young children. If a bone age is indicated for your child, it is best to get this done at a pediatric hospital if possible where the radiologists are experienced in interpreting pediatric x-rays.

The late bloomer

Some children are a normal size at birth but cross percentiles downwards and fall below the curve over the first 1-3 years of life. If the child then assumes a normal growth rate and follows her own curve which is beneath the 5th percentile, she is likely to be a late bloomer. This means that the child will go through puberty later than her peers, but will then jump back on the curve and end up at her genetic potential for height. Under these circumstances, the bone age will be delayed and this confirms the diagnosis. No treatment is required as this is what is termed a benign variant of normal growth. Furthermore, it frequently runs in families (ie, mother or father was a late bloomer). However, we can make this diagnosis even when we don’t know the family history if the child is small, growing at a normal rate, and has a delayed bone age.

In summary, not all small children have a growth problem. Growth rate is much more important than the absolute height. Children adopted internationally frequently are underweight initially

and their height upon referral may therefore not reflect their genetic potential. However, after 6 months of good nutrition and lots of love, most of these children will have found their natural height and weight curve and should continue to track along this. If this doesn't happen, further assessment is likely indicated which can be done by a pediatrician or pediatric endocrinologist.

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