

From the  
**Editors**

## Growing Up to a New Standard

WHO Growth Charts Make  
Breastfeeding the Norm



At a press conference at the United Nations in New York in April 2006, Dr. Cutberto Garza, Director for the United Nations University Food and Nutrition Programme, together with Mr. Rainer Gross, Chief of the Nutrition Section, UNICEF, presented the new international Child Growth Standards. “The WHO [World Health Organization] Child Growth Standards provide new means to support every child to get the best chance to develop in the most important formative years,” said Dr. Lee Jon-wook, Director General of WHO at the time.<sup>1</sup>

A result of WHO’s multi-country project involving more than 8,000 children from Brazil, Ghana, India, Norway, Oman and the U.S., the new standards confirm that a child born anywhere in the world and given the optimum start in life has the potential to develop within the same range of height and weight. Contrary to former standards, they set the bar by describing how children “should grow” when all their needs are met—as opposed to how they did grow in a particular region at a particular time—and base the data on healthy, breastfed infants. The resulting standards have been incorporated into age-based charts for height, weight, and body mass index (BMI).

Healthcare practitioners now have an effective tool for detecting undernutrition, overweight and obesity in children in all countries of the world. Given the rising obesity epidemic combined with the increase in prevalence of breastfeeding, these standards provide a better guide by which to help maintain optimum infant health during the formative years. Elisabeth Sterken, nutritionist and Director of INFACT Canada notes, “Parents and health practitioners can now feel confident that breastfed infants are growing opti-





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mally when they are 'less fat' than mixed-fed and formula-fed infants. Using breastfed children as the norm for growth is a critical development in the reduction of the overweight and obesity epidemic."<sup>2</sup>

### Properly Measuring Breastfed Infants

According to findings from the 2005 CDC National Immunization Survey (a nationally representative sample of the U.S. population), 72.9% of all U.S. infants were ever breastfed, 39.1% of infants were still breastfeeding at 6 months of age, and 20.1% of infants were breastfeeding at 1 year of age.<sup>3</sup> These numbers reflect a significant increase from the same survey in 2001, in which 32.5% of infants were still breastfeeding at 6 months.<sup>4</sup> According to Ryan et al.,<sup>5</sup> since 1990, the prevalence of the initiation of breastfeeding dramatically increased 35%, from 51.5% in 1990 to 69.5% in 2001.

While this is good news for the health of infants, it has posed some confusion to parents and healthcare practitioners, as breastfed babies grow at different rates from formula-fed babies. In 1992, Dr. Katherine Dewey conducted a study comparing the growth patterns of normal, healthy breastfed and formula-fed infants.<sup>6</sup> Dubbed the DARLING study (Davis Area Research on Lactation, Infant Nutrition, and Growth), the results showed that breastfed and formula-fed infants grow at basically the same rate in the first few months. However, between the ages of 4–6 months, formula-fed babies tend to gain weight faster than breastfed babies, although growth in length and head circumference were similar. After the first six months, breastfed babies tended to be leaner, gaining an average of one pound less during the first twelve months.<sup>7</sup> Researchers concluded that new standardized growth charts were needed to reflect the different growth patterns of healthy breastfeeding babies.



Growth charts reflecting this trend, however, have been slow in coming. Since the 1970s, the National Center for Health Statistics (NCHS)/WHO growth reference has been in use.<sup>8–9</sup> This reference was based on two sets of data, both using samples of American children from a restricted geographic area and with significant limitations—including the fact that the analytical methods at the time were inadequate and likely to inappropriately depict the pattern and variability of normal growth. In addition, the data were collected from predominantly formula-fed infants. To help remedy the

situation, in June 2000, the CDC released revised growth charts. The population studied to determine the desirable rate of growth included both formula-fed and breastfed infants, proportional to the distribution of breast- and formula-fed infants in the U.S. population. These charts were recommended for all infants in the United States, but did not take into account the international community, and were still skewed slightly heavy for exclusively breastfed infants.

"We now know that health workers," says Dr. Garza, "using the current references, too easily make faulty decisions regarding the adequate growth of breastfed infants and, thus, mistakenly advise mothers to supplement unnecessarily or to stop breastfeeding altogether. Given the health and nutritional benefits of breastfeeding...this potential misinterpretation of the growth pattern can have dire results."<sup>10</sup>

In 1993, WHO undertook a comprehensive review of the uses and interpretation of child growth references, concluding that the original NCHS/WHO reference wasn't adequate and that new growth curves were necessary.<sup>11</sup> The World Health Assembly endorsed this recommendation in 1994. In response, WHO undertook the Multicentre Growth References



Study (MGRS) between 1997 and 2003 to generate new curves for assessing growth and development of children worldwide.

### The MGRS Study

The MGRS combined a longitudinal follow-up from birth to 24 months (300 newborns per site) and a cross-sectional survey of children aged 18–71 months (1,400 children per site). Data were gathered from 8,400 healthy breastfed infants and young children from widely diverse ethnic backgrounds and cultural settings (Brazil, Ghana, India, Norway, Oman and

USA). The MGRS is unique in that it was purposely designed to produce a standard by selecting healthy children living under conditions likely to favor the achievement of their full genetic growth potential. For example, the mothers of the children selected engaged in fundamental health-promoting practices, namely breastfeeding and not smoking.

First, experts reviewed about 30 growth-curve construction methods, including types of distributions and smoothing techniques, to identify the best approach to constructing the standards. Next, they selected a software package flexible enough to allow the comparative testing of the alternative methods used to generate the growth curves. They then applied this approach systematically to search for the best models to fit the data for each indicator.<sup>12</sup> Factors that contributed to success were modern communication systems that allowed close and frequent contact between the Coordinating Centre and the sites, continuous monitoring of data quality, the early detection and adoption of remedial measures for identified problems, and ongoing standardization within and between sites.<sup>13</sup>

The methodology generated—for boys and girls aged 0 to 60 months—percentile and z-score curves for length/height-for-age, weight-for-age, weight-for-length, weight-for-height, and BMI-for-age. Also included is the Windows of Achievement standard for six key motor development milestones such as sitting, standing and walking, which is an addition to the set of indicators previously available as part of the NCHS/WHO reference. In-depth descriptions are presented of how each sex-specific standard was constructed, as well as comparisons of the new WHO standards with the NCHS/WHO growth reference and the CDC 2000 growth charts.

### Comparing Old and New Charts

The study methods leading to the new WHO standards were significantly different from those used to create former standards. For example, to address the significant skewness of the original NCHS/WHO sample's weight-for-age and weight-for-height, separate standard deviations were calculated for distributions below and above the median for each of the two indicators. (This approach is limited in fitting skewed data, especially at the extreme tails of the distribution, since it only partially adjusts for the skewness inherent in the weight-based indicators.) The WHO standards, on the other hand, employed LMS-based



### Discrepancies Between Old & New Charts:<sup>2,16</sup>

When using the new WHO growth charts, healthcare workers may see some discrepancies between old and new standards in childhood growth. These are simply reflective of the new, breastfeeding norm.

- The existing weight requirements for two- and three-year-olds were 15–20% too high.
- The formula-fed standard put a healthy one-year-old between 22.5–28.5 pounds, whereas the healthy breastfed infants weighs between 21–26 pounds.
- The differences in growth rates and patterns between exclusively breastfed and formula-fed infants become evident at the early age of two–three months.
- The daily energy intake for babies should be about 7% less than current levels.
- Stunting (low height for age) will be greater throughout childhood when assessed using the new WHO standards.
- There will be a substantial increase in underweight rates during the first half of infancy (0–6 months) and a decrease thereafter.
- Wasting (low weight for length/height) rates during infancy will be substantially higher.
- A greater prevalence of overweight will be present, varying by age, sex, and nutritional statuses of the index population.





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methods that fit skewed data adequately and generate fitted curves that follow closely the empirical data. Like the WHO standards, construction of the CDC 2000 growth charts was also based on the LMS method and, therefore, differences between this reference and the WHO standards are largely a reflection of differences in the populations on which the two sets of curves were based.<sup>14</sup>

The standards themselves also differ in many ways. As such, healthcare workers may notice a higher incidence of stunting, underweight and wasting, simply because the new charts are based on the slowed-down, breast-fed growth pattern proposed by WHO. For example, stunting may be greater throughout childhood when assessed using the new WHO standards compared to the NCHS/WHO reference. The growth pattern of breastfed infants may result in a substantial increase in rates of underweight during the first half of infancy and a decrease thereafter. Wasting rates during infancy may be substantially higher using the new WHO standards, and the prevalence of overweight will be greater, varying by age, sex and nutritional status of the index population.

Unlike prior standards, WHO pooled samples from six participating countries, allowing the development of a truly international standard and reiterating the fact that child populations grow similarly across the world's major regions when their healthcare needs are met. WHO standards also include new innovative growth indicators beyond height and weight that are particularly useful for monitoring the increasing epidemic of childhood obesity, such as skinfold thicknesses.

The study's longitudinal nature also allows the development of growth velocity standards. Healthcare providers won't have to wait until children cross an attained growth threshold to make the diagnosis of under-nutrition and overweight. Velocity standards will enable the early identification of children in the process of becoming under- or over-nourished.

Lastly, the development of accompanying windows of achievement for six key motor development milestones will provide a unique link between physical growth and motor development.

### Implementation of the New Charts

An important characteristic of the new reference is that it makes breastfeeding the biological "norm." Previous standards had higher weights as they were based on mixed-fed children, who statistically are heavier than breastfed children. The use of these standards raised concerns about "overfeeding" or "topping up" infants to match the development of formula-fed infants, based on a frequently held misconception that breastfed babies did not grow fast enough.

For the first time, healthcare practitioners now have a technically robust tool to measure, monitor and evaluate the growth of all children worldwide, regardless of ethnicity, socioeconomic status or type of feeding. Under-nutrition, overweight and obesity, and other growth and nutrition-related conditions can be detected and addressed earlier in the child's life. "From infancy through age five," says Chessa Lutter, regional advisor on food and nutrition at the Pan American Health Organization (PAHO), "children's growth is much more influenced by things like breastfeeding, good nutrition, healthcare, and other environmental factors than by genetics or ethnicity. No matter what country or ethnic group they're from, children will grow in a similar way as long as they are properly fed and have good health conditions."<sup>15</sup>

Ahead lies the implementation of the new references. At present, 99 countries are using the NCHS/WHO growth reference. The goal is for the majority of these countries to have adopted the new standards by 2010.<sup>16</sup> Results of a WHO survey found that replacing the existing charts and retraining fieldworkers in their use and interpretation must go beyond simply swapping charts to include revisiting growth-monitoring practices as a whole. Intensive training efforts at all levels will be necessary to help overcome the difficulties health workers experience as well as to disseminate knowledge about effective interventions to prevent or treat either excessive or inadequate growth at both the individual and the population levels. To be successful, these future efforts will require a number of key partnerships.<sup>17</sup>



"Chronic diseases later in life, like diabetes and chronic cardiovascular diseases, can be largely prevented with a good start in life," says Denise Costa Coitinho, Director of WHO's Department of Nutrition for Health and Development. "This can be achieved with the early diagnosis and the correction of excessive weight, for example, with breastfeeding, with adequate complementary feeding...The current obesity epidemics in many countries could have been detected earlier and hopefully even avoided if we had had such standards available before."<sup>19</sup>

As for the United States, implementation of the new WHO charts remains uncertain. According to the CDC, in the past two decades, approximately one-half of all infants in the U.S. received some breast milk and approximately one-third were breast-fed for 3 months or more.<sup>18</sup> Still, that leaves many infants who are still either partially or fully formula-fed. The 2000 CDC charts take this combination into consideration, combining both breast-fed and formula-fed infants to determine optimal growth. The Department of Health and Human Services (CDC and NIH) and the American Academy of Pediatrics convened an expert panel in June 2006 to consider using the new WHO charts versus the CDC charts. The panel compared the 2000 CDC growth charts to the new WHO charts and examined how U.S. children might be assessed differently using the two references. The CDC states

that guidance will soon be developed to help health-care practitioners avoid confusion when monitoring growth within the U.S. population. •

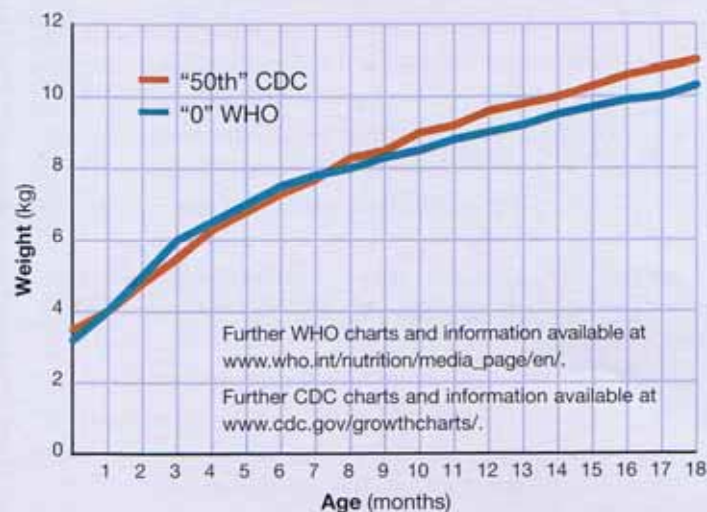
## References

1. World Health Organization and the United Nations University Release New Child Growth Standards. The United Nations University. Press Conference, April 27, 2006. Accessed at: <http://www.un.org/News/Press/docs/2006/20060427.unu.nu20060427.html>.
2. WHO Child Growth Standards important landmark in improving infant and young child nutrition, April 27, 2006. INFACT Canada (Infant Feeding Action Coalition). Accessed at: [http://www.infactcanada.ca/press\\_release\\_April\\_27\\_2006.htm](http://www.infactcanada.ca/press_release_April_27_2006.htm).
3. Breastfeeding: Data and Statistics: Breastfeeding Practices—Results from the 2005 National Immunization Survey. Centers for Disease Control and Prevention, Department of Health and Human Services. Accessed 10/06 at: [http://www.cdc.gov/breastfeeding/data/NIS\\_data/data\\_2005.htm](http://www.cdc.gov/breastfeeding/data/NIS_data/data_2005.htm)
4. Ryan A, Wenjun Z, and Acosta A. Breastfeeding continues to increase into the new millennium. *Pediatrics* Vol. 110 No. 6. December 2002, pp. 1103-1109.
5. *Ibid.*
6. Dewey KG, Heinig MJ, Nommsen LA, Lönnerdal B. Adequacy of energy intake among breast-fed infants in the DARLING study: relationships to growth velocity, morbidity, and activity levels. *Davis Area Research on Lactation, Infant Nutrition and Growth. J Pediatr.* 1991 Oct;119(4):538-47.
7. How much weight should I expect my breastfeeding baby to gain? <http://www.askdrsears.com/html/2/7023600.asp>
8. De Onis M, Yip R. The WHO growth chart: historical considerations and current scientific issues. In: Ponnini M, Walter P, eds. *Nutrition in pregnancy and growth. Bibi Nutr Dieta 1998;53:74-89.*
9. National Center for Health Statistics. Growth curves for children birth-18 year. United States. Vital and Health Statistics, Series 11, No. 165. Department of Health, Education, and Welfare Publication No. 78-1650. Washington, D.C.: U.S. Government Printing Office, 1977.
10. Susan Lang, Cornell experts help call for new international child-growth references. *Cornell Chronicle.* Vol. 29, Number 1, August 21, 1997. Accessed at: <http://www.news.cornell.edu/chronicle/97/8.21.97/child-growth.html>.
11. Child Growth Standards, Executive Summary, World Health Organization. Accessed at: [http://www.who.int/childgrowth/standards/tr\\_summary/en/index.html](http://www.who.int/childgrowth/standards/tr_summary/en/index.html).
12. *Ibid.*
13. de Onis M, Garza C, et al. The WHO multicentre growth reference study: planning, study design and methodology. *Food and Nutrition Bulletin.* Vol. 25, No. 1 (supplement 1): 2004. The United Nations University.
14. Child Growth Standards, Executive Summary, World Health Organization. Accessed at: [http://www.who.int/childgrowth/standards/tr\\_summary/en/index.html](http://www.who.int/childgrowth/standards/tr_summary/en/index.html).
15. New child growth standards. *PAHO Today, The Newsletter of the Pan American Health Organization,* August 2006. Accessed at: [http://www.paho.org/english/dd/pin/ptoday09\\_aug06.htm](http://www.paho.org/english/dd/pin/ptoday09_aug06.htm).
16. Child and growth development. World Health Organization. <http://www.who.int/childgrowth/faqs/en/>.
17. De Onis M, Yip R. The WHO growth chart: historical considerations and current scientific issues. In: Ponnini M, Walter P, eds. *Nutrition in pregnancy and growth. Bibi Nutr Dieta 1998;53:74-89.*
18. Frequently asked questions about the 2000 CDC growth charts. CDC National Center for Health Statistics. <http://www.cdc.gov/nchs/about/major/nhanes/growthcharts/GrowthchartFAQs.htm>.
19. Lisa Schlein. WHO releases new child growth standards. *Voice of America,* May 3, 2006. Accessed at: <http://www.voanews.com/burmese/archive/2006-05/2006-05-03-voa8.cfm>.

## WHO and CDC, Side by Side

A direct comparison of the WHO and CDC growth charts shows significant differences in weight standards, particularly for infants 8 months and older.

### Weight-for-age girls, birth to 18 months



"From infancy through age five," says Chessa Lutter, regional advisor on food and nutrition at the Pan American Health Organization (PAHO), "children's growth is much more influenced by things like breastfeeding, good nutrition, healthcare, and other environmental factors than by genetics or ethnicity. No matter what country or ethnic group they're from, children will grow in a similar way as long as they are properly fed and have good health conditions."