Time for a New Growth Reference

ABSTRACT. The National Center for Health Statistics growth reference, recommended by the World Health Organization for international use since the late 1970s, has served many useful purposes. Among the most important are the provision of a single set of growth references for the assessment of the general nutritional status of populations of children in diverse settings, as an ancillary tool to screen children for health and nutrition disorders, and as a basis for educational materials that promote improved child care by families. However, because of serious drawbacks due to the origin and type of data used for their construction and the analytical methods applied in their derivation, the suitability of these curves for international purposes has been challenged recently. *Pediatrics* 1997;100(5). URL: http://www.pediatrics.org/cgi/content/full/100/5/e8; *breastfeeding, growth monitoring, growth references, anthropometry, nutrition assessment.*

ABBREVIATIONS. NCHS, National Center for Health Statistics; WHO, World Health Organization.

The National Center for Health Statistics (NCHS) growth curves were constructed by combining two distinct data sets compiled in different time periods. For children under 2 years of age the data came from the Fels Longitudinal Study carried out in Yellow Springs, Ohio, from 1929 to 1975; the Fels curves reflect the growth of children who were fed primarily infant formula and in whom complementary feeding often was initiated before 4 months. The group was of homogeneous genetic, geographic, and socioeconomic backgrounds. For older children, the data came from nationally representative cross-sectional surveys of children in the United States and include all ethnic groups and social classes. Furthermore, the younger children were measured supine (length) and older children were measured standing (height). As a result there is a marked discrepancy in estimated height status immediately before and after 24 months of age, where the two curves ideally should merge seamlessly. This disjunction of about half a standard deviation or 1.8 cm, complicates the interpretation of growth data from nutrition surveys and surveillance activities.[1] In addition, there is a positive skew in the weight distribution, reflecting a substantial level of childhood obesity. This upward skewness reflects an "unhealthy" characteristic of the NCHS reference population and may result in the misclassification of overweight children as "normal."[1]

More importantly, concern also has been expressed that the NCHS curves are inappropriate for healthy, breastfed infants. Recent research shows that infants fed according to recommendations by the World Health Organization (WHO)[2] and who live under conditions that favor the achievement of genetic growth potentials grow less rapidly than, and deviate significantly from, the NCHS reference.[3,4] The negative deviations are large enough to lead health workers to make faulty decisions regarding the adequate growth of breastfed infants, and thus to mistakenly advise mothers to supplement unnecessarily or to stop breastfeeding altogether. Given the health and nutritional benefits of breastfeeding,[5] this potential *misinterpretation* of the growth pattern of healthy breastfed infants has great public health significance. The premature introduction of complementary foods can have life-threatening consequences for young infants in many settings, especially where breastfeeding's role in preventing severe infectious morbidity is crucial to child survival.

Proper identification of growth faltering remains important. Malnutrition is a major determinant of child survival and results in poor physical and cognitive development among its survivors. It is thus a major determinant of human development. We recognize that 6.6 million out of 12.2 million deaths among children under 5—or 54% of child mortality in developing countries—is associated with malnutrition, the majority of which is due to the potentiating effect of mild-to-moderate malnutrition as opposed to severe malnutrition.[6] Thus, strategies that focus only on severely malnourished children will be insufficient to improve child survival globally and inadequate in addressing malnutrition's toll on human development. The most significant impact can be expected when ***all*** grades of malnutrition are targeted. This underscores the need for a technically sound growth reference that supports the identification of the earliest signs of poor growth and, thus, promotes early remedial action to prevent the cycle that unbroken leads to severer forms of malnutrition, increased rates of mortality, and poorer development in at-risk communities.

Given the capital importance of these issues to child health and survival, a recent WHO expert committee concluded that a new growth reference was needed urgently to enhance the nutritional management of infants.[1] This recommendation was endorsed in 1994 by the World Health Assembly (resolution WHA47.5). The development of a new growth reference also is regarded as long overdue by most members of the scientific and public health communities with interests in infant and child health.

To construct a sound reference of lasting value, WHO has concluded that a multi-country growth

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study specifically designed to develop a growth reference is necessary. The new reference sample should be based on breastfed infants living in *healthy* environments that do not limit their genetic growth potential. Measurements should be taken at sufficiently frequent intervals to allow proper characterization of growth patterns using appropriate up-to-date curve-fitting techniques. Finally, the sample size should be large enough to ensure that centile curve estimation is stable.

Applying the committee's prescription[1] for the formulation of a truly international reference, ie, one drawn from several countries, is expected to improve the estimate of the variability of physiologic growth and help evaluate reasons for differences between the variability in growth in the current reference and in the initial analyses conducted by WHO.[3] No less important, such an approach will minimize political difficulties that arise from the use of a single country's child-growth data as a reference and, by default, as a worldwide "standard" for optimal growth.

Together with the development of a new growth reference, emphasis should be placed on its appropriate use. Ways in which a reference are interpreted and the clinical and public health decisions taken on its basis are of fundamental importance. For clinical or individual-based applications, far from serving as a self-sufficient diagnostic tool, reference values should be used as a screening tool to detect individuals at greater risk of health or nutritional disorders. For population-based applications, reference values should be used for comparison and monitoring purposes. In populations, a high prevalence of anthropometric deficits implies that the entire population is at risk of significant health and nutritional problems. Thus, even children who are not below conventional cut-off points for defining malnutrition are at increased risk and should be taken into account in intervention programs. The development of a new reference will require research and education on its appropriate uses.

A protocol for the development of a new growth reference is under preparation by an international group of experts brought together by WHO. This effort is linked to the development of effective community-based interventions for the improvement of child growth and development, another WHO initiative. The development of a new growth reference and the promotion of its worldwide use are extremely complex, costly and time-consuming undertakings; however, with the support of the international nutrition community—governments, intergovernmental and nongovernmental organizations, research institutions, and health professionals worldwide with strong commitments to infant and young child health—the world will celebrate the arrival of the next millennium with a technically sound growth reference on the horizon that will enhance the nutritional management of infants and young children and thus support their improved survival and development.

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