North Bengal Anthropologist (2016) Vol. 4: 214-221
annualy

National Centre for Health Statistics (NCHS) Reference

[1]Isita Sinha

Abstract: Growth is a kind of velocity and measures the rate of change of size over a certain period of time. Growth measurements are taken at regular intervals over a specified period of time. Growth assessment is basically a kind of comparison with a reference normally called a "*growth reference*". Without such a reference, growth assessment becomes arbitrary. Until the late 1970s, a number of growth charts were utilized to assess child growth. In the year 1977, the National Centre for Health Statistics (NCHS) published a new set of growth charts for children aged <18 years based on data from the Fels Longitudinal Growth Study and nationally representative surveys. The NCHS later became a part of the Centre for disease control (CDC) in the year 1987. The NCHS growth charts consists of 14 sex specific growth charts and used different indicators like weight-for-age, weight- for- length, length-for-age, head circumference for age stature-for-age and weight-for-stature. These curves represent attained size, and do not describe rates of growth as might be represented in incremental or longitudinal growth charts. It utilizes per centile rankings to describe the relative size of a given child. The main advantage of NCHS reference is that the data was based on current and high quality growth data as well as on the most recent advances in data processing and analysis.
Key words: Growth, growth reference, nutrition, height, weight, malnutrition.

Introduction

The National Centre for Health Statistics (NCHS) is the United States (U.S) nation's principle health statistics agency, providing data to identify and address health issues. Since the 1970s the World Health Organization (WHO) has published several versions of growth references, recommended for international use to help assess children growth and nutritional status. Growth references are one of the commonly used tools for assessing the well being of groups of children and an individual's progress in reaching a range of health and other markers of social equity. Thus far, there are three widely known and used versions: the 1978 WHO/NCHS Growth References (for children up to age ten), the WHO Growth References (for children and adolescents up to age nineteen), and the 2006 WHO Growth Standards (for preschool children, under 6 years of age). In the year 1971, the American Academy of Paediatrics, the Maternal and Child Health Program of the Bureau of Community Health Services and the U.S. Public Health Services recommended new growth charts based on data from the NCHS Health Examination Surveys. This led to the development of the NCHS Growth Charts. The NCHS Growth Charts were released in the year 1977 and were recommended for the clinical assessment of infants and children (Owen, 1973). . These NCHS Growth Charts included anthropometric measurements such as weight-for height, weight-for-age, height-for-age, and head circumference-for-age. The NCHS reference is cur-

[1] Research scholar, Department of Anthropology, University of North Bengal, Email: seriousishita@gmail.com

rently used in the national programmes of about 100 countries. Since the evaluation of child growth trajectories and the interventions designed to improve child health are highly dependent on the growth charts used, it is important to understand the impact of using the WHO versus the NCHS charts on the assessment of growth and estimates of malnutrition.

Collaboration with International Organization

The NCHS collaborates with international organizations to increase the availability of internationally comparable data, track global health statistics, and improve statistical systems worldwide. Some example of collaborations is as follows-

- World Health Organization (WHO) Collaborating Centre for the Family of International Classifications for North America
- The International Classification of Diseases (ICD)
- The International Classification of Functioning, Disability and Health (ICF)
- United Nations
- The Washington Group on Disability Statistics (WG)
- United Nations Children's Fund (UNICEF)

The NCHS engages in a number of special projects, contributing its expertise to improve health-related data collections. An example is the Global Program for Civil Registration and Vital Statistics Improvement, collaboration between NCHS and the Centre for Global Health through which country demonstration projects in Kenya, Malawi, and Morocco have been established to improve their civil registration and vital statistics systems.

Goal of NCHS Growth Charts

National Centre for Health Statistics (NCHS) growth charts are used to assess height and weight for individuals from birth to 18 years of age.Weight for height can be assessed by NCHS growth charts. The main aim of this growth chart is to assess the nutritional status of young infants in United States. This growth charts have become the standard of care for assessing the appropriateness of growth for approximately 82 million children under the age of 20 years in U.S. This reference also show the relationship between body weight and stature of prepubescent children. We use NCHS growth reference due to certain demerits of fels data. The demerits of fels data are as follows:

(i). The Fels data came from a single longitudinal study of infants from 1929 to 1975. The data was recorded mainly from formula fed, white middle-class infants.

(ii). The data was collected from infants residing in a small, limited geographic area of south-western Ohio. Hence it was not a nationally representative data.

(iii). The data was collected at birth and 1 month, at 3-month intervals from 3 to 12 months, and at 6-month intervals from 12 to 36 months. These intervals are not adequate to identify growth patterns during periods of rapid change.

(iv). The size and growth patterns of Fels infants may not adequately represent current growth patterns of combined breast-fed and formula-fed infants in the U.S. population.

(v). There is an absence of the weight-for-stature references for adolescents.

(vi). The Fels infant study could not assess the growth of individuals aged 18 years and over.

Characteristics of NCHS Growth Charts

The basic characteristics of the growth charts were not altered in the revised growth curves. NCHS curve cover different indicators such as weight-for-age, length-for-age, weight-for-length, and head circumference-for age. NCHS curve is sex-specific. Both NCHS and CDC (Centre for disease control) curves are expected to be used for all U.S. populations regardless of race/ethnicity, parental anthropometry or infant feeding modality. It represents a "reference" rather than a "standard," in that it should be interpreted as the actual growth of other infants in the U.S and not how infants optimally should grow.These curves represent attained size, and do not describe rates of growth as might be represented in incremental or longitudinal growth charts. Finally, it is utilize per centile rankings to describe the relative size of a given child. The 1977 NCHS Growth Charts consists of 14 sex-specific growth charts. These growth charts were developed for infants aged from birth to 36 months and for children aged from 2 years to 18 years (Hamill et al., 1977). The 1977 NCHS charts are applicable to boys with stature from 90 cm to 145 cm and under 11.5 years of age, and to girls with stature from 90 cm to 137 cm and under 10.0 years of age for weight-for-age. They are not applicable for any child showing the signs of early puberty.

The NCHS growth charts are as follows*:*

Weight-for-age Birth to 36 months 2 years to 18 years
Length-for-age Birth to 36 months
Weight-for-length Birth to 36 months Boys (49 cm to 103 cm) Girls (49 cm to 101 cm)
Head circumference-for-age Birth to 36 months
Stature-for-age 2 years to 18 years
Weight-for-stature Boys (90 cm to 145 cm) Girls (90 cm to 137 cm**)**

Sources of data of NCHS growth charts

It was only when nationally representative cross-sectional survey data became available for the United States for most of the age range among children that growth charts began to be developed by the NCHS. Data from the following sources were used to develop the NCHS Growth Charts:

a) Data from the II[nd] National Health Examination Survey (NHES) II (1963 – 1965) for ages 6 years – 11 years.
b) Data from the III[rd] National Health Examination Survey (NHES) III (1966 – 1970) for ages 12 years – 17 years.
c) 1[st] National Health and Nutrition Examination Survey (NHANES) I (1971–74) for ages 1 year – 17 years.

Since the U.S. National survey data were not available for the period from birth to 1 year, the NCHS used the national survey data available from the longitudinal growth study of the Fels Research Institute in Yellow Springs, Ohio. The NCHS charts from birth to 3 years are solely based on Fels data.

Nutrition Data

NCHS has been collecting dietary data on the U.S. population for more than 40 years. The primary data source for monitoring nutrition is the National Health and Nutrition Examination Survey (NHANES), using personal interviews, standardized physical examination and laboratory test. Through NHANES, NCHS obtain National representatives data on dietary intakes and behaviours, biomarkers of nutritional status, body measurements (such as height and weight) and body composition. Federal agencies, researchers, educators, health care providers and policy makers use these data to:

a) Assess and monitor the nutritional status of the U.S population.
b) Identify nutrient deficiencies /excess
c) Examine the association of diet with health and disease.
d) Inform nutrition programs
e) Examine the impact of nutrition policies over time.

Dietary Intake and Behaviour

The NHANES data on dietary intake are used to estimate food and nutrient intakes by the U.S. population and by specific age, gender, race / ethnic groups.

a) Most adults (about 90 per cent) consume more sodium than is recommended. In 2009-2010, average consumption of sodium exceeded the maximum daily limit (<2300 mg) for adults 20 years and older.
b) Approximately 13 per cent of adult's total caloric intake came from added sugars in 2005-2010.
c) Almost half of the adult population (49 per cent) used a dietary supplement during 2007-2010 compared to 42 per cent of adults in 1988-1994.

Growth charts workshop

In December 1992, the NCHS sponsored the 1[st] workshop to look into the concerns that were raised about the 1977 NCHS Growth Charts. Since then, a number of workshops were sponsored by the NCHS to obtain expert input for revising the 1977 NCHS Growth Charts. The WHO independently also began to extensively review the uses and interpretations of growth information. The aim of these workshops was to provide options and recommendations that would be considered in making final decisions on how best to assess human growth.

Advantages of NCHS growth charts

The NCHS charts were constructed using current body measurement data and exploiting the most recent advances in data analysis and computer technology. The NCHS data are derived either from the Fels Research Institute or from the Health Examination Surveys of the National Centre

for Health Statistics. The NCHS reference is benefited from the advice offered by many interested agencies and individuals; most importantly they benefited from the Preschool Nutrition Survey of 1968-70. The NCHS data are based on current and high quality growth data as well as on the most recent advances in data processing and analysis. These charts should be worthy replacements for the venerable Stuart-Meredith charts, which first appeared in 1946. For clinical use, however, accurate growth charts for widespread dissemination based on the NCHS per centiles have already been produced by the Ross Laboratories, Columbus, Ohio. Several major research and service projects, which will be facilitated by computer processing of large amounts of anthropometric, clinical, and nutritional data in comparison with the NCHS reference data. The widespread use of this common standard reference will facilitate the much needed comparative and standardized studies of populations, Both on national and international levels. Because of the nature and efficiency of the samples, all the NCHS data provide somewhat more reliable population estimates, and of known quality and reliability, than are provided by the corresponding data from the Fels Research Institute. The sampling design of the Fels data is acknowledged to be limited geographically, culturally, socioeconomically, and genetically. In addition, careful comparisons of the Fels body measurements with NCHS data show that, although the median values are quite similar, both the low and high outer per centiles are slightly restricted in the Fels data; that is, the Fels population is slightly less heterogeneous than is the more nationally representative NCHS sample.

Uses of NCHS data

a) ***Guiding National Policy:*** NCHS data are used to set national priorities, develop policy initiatives, and track the outcomes of policy changes. The health insurance coverage in 2009 showed that 21 per cent of 18–64 year olds currently lacked health insurance coverage. Nutrition policy,NCHS data are used to recommend and evaluate food fortification decisions, to develop and evaluate the Dietary Guidelines for Americans, and to help set the recommended intake levels for vitamins, minerals, and other nutrients. Data show that, since the 1990s, intake of milk and dairy foods improved somewhat, but intake of vegetables and whole grains declined. Environmental exposure. Exposures to lead and second-hand smoke in women of childbearing age and in young children continue to decline. Cardiovascular disease mortality. The downward trend in heart disease and stroke death rates reflects changes in risk factors decline in cigarette smoking, a drop in cholesterol levels, and better control of hypertension.
b) ***Monitoring and Improving Health Behaviour:*** The NCHS data measure risk factors and guide efforts to promote healthy lifestyles. Tobacco control. In 2009, about one-fifth (20.6 per cent) of adults aged 18 and over were smokers. Although there was no change between 2008 and 2009, smoking among U.S. adults declined from 24.7 per cent in 1997 to 20.6 per cent in 2009. Teen births. The birth rate for U.S. teenagers 15–19 years fell 2 per cent in 2008, to 41.5 per 1,000, reversing a brief 2-year increase that had halted the long-term decline from 1991 to 2005. In 2006–2008, more than 4 in 10 teenagers reported having had sex. Overweight and obesity. An estimated 34.2 per cent of U.S. adults aged 20 and over are overweight, 33.8 per cent are obese, and 5.7 per cent are extremely obese, according to estimates for 2007–2010.

Limitations

The NCHS/WHO curves were upwardly skewed resulting in an underestimation of obesity. In 1978, the WHO/CDC produced a normalized version of the US C-DC/NCHS growth curves, showing *Z* -scores instead of absolute anthropometric values. It was called the 1978 WHO/NCHS Growth References, and has been widely used all over the world since then. However, it has a

number of limitations (Wang et al. 2006). For example, one of its main limitations is about representativeness, because the growth reference for infants was developed based on data collected from the Fels Longitudinal Study, which followed mainly formula-fed children in an area in Ohio State in mid-west of the USA. Moreover, these children were followed with large time intervals, which provided insufficient data to describe the rapid and changing rate of growth in early infancy (Kuczmarski et al. 2002). Recent studies have shown that the growth pattern of breast-fed infants differed from that of formula-fed infants (Victora et al. 1998; de Onis and Onyango 2003). NCHS charts, which accurately represent the growth of children in the United States, will probably not have to be constructed for a long time because of the technical quality of these Charts & population estimates and also because children's growth rates, which had been increasing for the past century or more, have apparently stabilized, at least for the present.To overcome these limitations, new growth references and standards have been developed in the US in 2000 and by the WHO in 2006.

Comparison between WHO Standard and NCHS Reference

There are important differences between the new WHO standards and the NCHS/ WHO reference; these vary by age group, growth indicator, specific per centile or Z-score curve, and the nutritional status of the index populations. Differences are particularly important during infancy, as only breast-fed infants were included in the WHO sample and formula-fed were predominant in the NCHS/WHO reference. Moreover, differences in measurement intervals -between the two sets of curves (every 2 wk in the first two months and monthly thereafter in the WHO standards versus every 3 months in the NCHS reference) in a period of rapid growth also may explain the divergent growth patterns. Differences in the variability of normal growth depicted by the WHO standards and the NCHS reference are probably the result of the prescriptive approach and updated analytical methods on which the WHO standards are based. The difference in the shapes of the weight-based curves makes the interpretation of growth performance different depending on whether the WHO standard or the NCHS/ WHO reference is used; this has important implications for the advice given to mothers concerning lactation performance and the introduction of complementary foods. Variations in the ages of children studied, average attained length/height and proportions with excess or deficient weight-for-length/height make it impossible to define any algorithm that could be used to derive WHO standards-based prevalences from NCHS/WHO reference-based estimates. It is expected that stunting will increase throughout childhood when assessed using the WHO standards compared with the NCHS/WHO reference. Underweight rates will usually be higher when based on the WHO standards compared with rates based on the NCHS/WHO reference during the first half of infancy (*i.e.*, 0-6 months) and lower thereafter. For wasting, the main difference between the new standard and the o-ld reference is also during infancy (*i.e.* up to about 70 cm length) when wasting rates will be substantially higher using the WHO standard. Severe wasting, which is the criterion used for enrolling children in therapeutic feeding , will also increase substantially throughout childhood when the WHO standard is applied.

Conclusion

The NCHS growth reference provides different advantages over various older growth curves or WHO standard. This is considered that it is a most practical method for assessing the nutritional status of young children of United States. After study it is concluded that more recent and comprehensive U.S. national data on anthropometric measurements among U.S. children were becoming available. New additional U.S. national survey information was available after the publi-

cation of the 1977 NCHS Growth Charts. So that it may be concluded that the study of NCHS growth reference is necessary to know the importance of its uses in comparisons with other growth charts for assessing the nutritional status of young infants (<18) in United States.

References

Cameron, N. 2002. *Human Growth and Development*. London: Academic Press.

Cole, T.J., M.C. Bellizzi, K.M. Flegal, and W.H. 2000. Establishing a standard definition for child overweight and obesity worldwide: international survey. *British Medical Journal* 320:1240–1243.

de Onis, M. and J.P. Habicht. 1996. Anthropometric reference data for international use: Recommendations from a World Health Organization expert committee. *American Journal of Clinical Nutrition* 64:650–658.

Dibley, M.J., J.B. Goldsby, N.W. Staehling, and F.L. Trowbridge. 1987. Development of normalized curves for the international growth reference: Historical and technical considerations. *American Journal of Clinical Nutrition 46:736*–748.

Hamill, P.V., T.A. Drizd, C.L. Johnson, R.B. Reed, A.F. Roche, and W.M. Moore. 1979. Physical growth: National Center for Health Statistics per centiles. *American Journal of Clinical Nutrition* 32:607–609.

Hamill, P.V., T.A. Drizd, C.L. Johnson, R.B. Reed, and A.F. Roche. 1977. NCHS growth curves for children birth–18 years United States. *Vital Health Stat*istics 11:1-74.

Kuczmarski, R.J., C.L. Ogden, L.M. Grummer-Strawn, K.M. Flegal, S.S. Guo, R. Wei, Z. Mei, L.R. Curtin, A.F. Roche, and C.L. Johnson. 2000. *CDC Growth Charts: United States. Advance data from vital and health statistics no 314*.

Lohman, T., R. Martorell, and A.F. Roche. 1998. *Anthropometric Standardization Reference Manual*. Champaign, IL: Human Kinetics.

Owen, G.M. 1973.The assessment and recording of measurements of growth of children: Report of a small conference in *Pediatrics* 5:461–466.

Roche, A.F., and J.I. McKigney. 1976. Physical growth of ethnic groups comprising the U.S. population. *American Journal of Diseases of Children* 130:62–64.

Scammon, R.E. 1927.The first seriatim study of human growth. *American Journal of Physical Anthropology* 10:329–336.

Tanner, J.M. 1981. *A History of the Study of Human Growth*. Cambridge: Cambridge University Press.

Van't Hof, M. A., F. Haschke, S. Darvay, and the Euro-Growth Study Group. 2000. Euro Growth references on increments in length, weight, and head and arm circumferences during the first three years of life. *Journal of Pediatric Gastroenterology and Nutrition* 31:S39–S47.

Waterlow, J.C., R. Buzina, W. Keller, J.M. Lane, N.Z. Nichaman, and J.M. Tanner. 1977. The presentation and use of height and weight data for comparing the nutritional status of groups of children under the age of 10 years. *Bulletin of the World Health Organisation* 55:489–98.

World Health Organization. 1978. *A growth chart for international use in maternal and child health care: Guidelines for primary health care personnel.* Geneva: World Health Organization.

World Health Organization.1994. Working Group on Infant Growth. An evaluation of infant growth. Document ref WHO/NUT/94.8. Geneva: World Health Organization.

WHO Working Group on Infant Growth. 1995. An evaluation of infant growth: The use and interpretation of anthropometry in infants. *Bulletin of the World Health Organisation* 73:165–174.

World Health Organization. 2006. *WHO child growth standards: length/height-for-age, weight-for-age, weight-for-height and body mass index-for-age: Methods and development.* Geneva: World Health Organization.