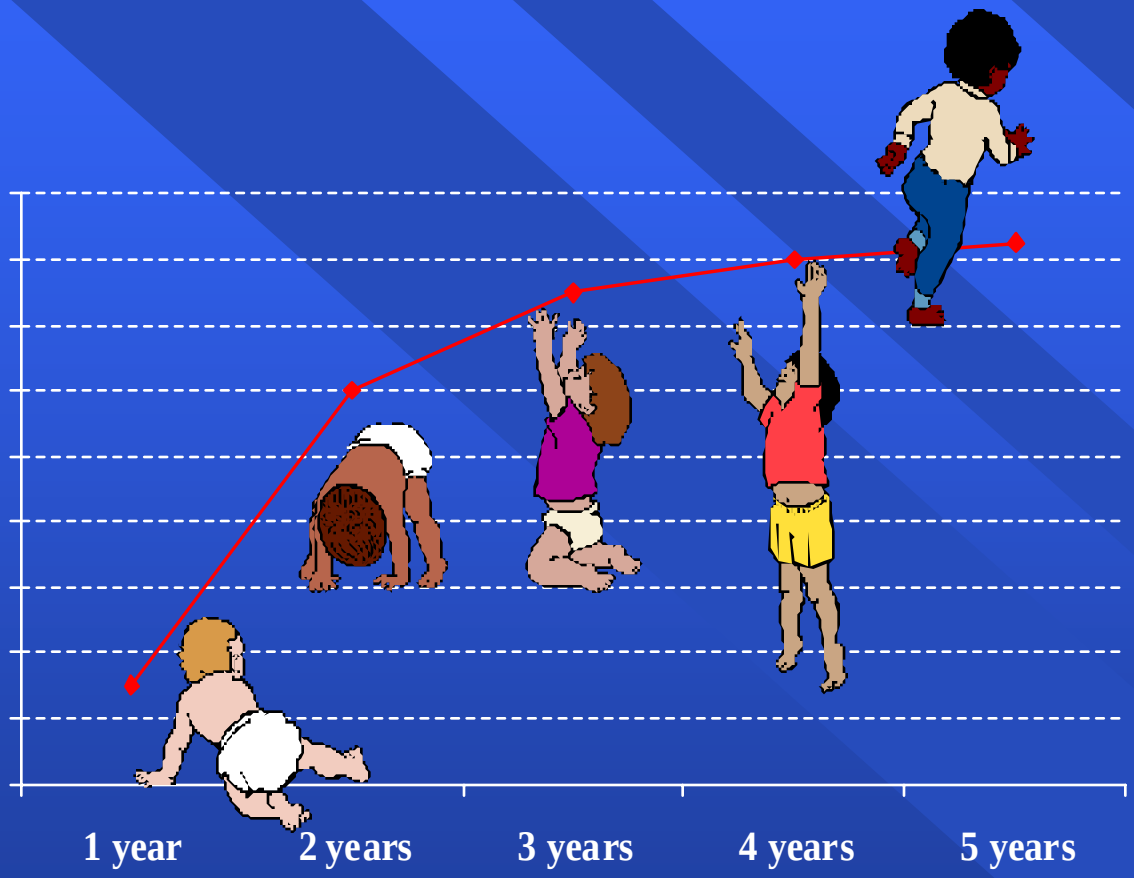
WHO International Growth Standard



Background and Rationale: Raising the Bar, The WHO Growth Standard

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Growth Reference Study Objective

To build a set of growth curves for children below 5 years of age to be adopted as a new international growth standard for assessing the growth and nutritional status of populations and individual children.

WHO Multicentre Growth Reference Study

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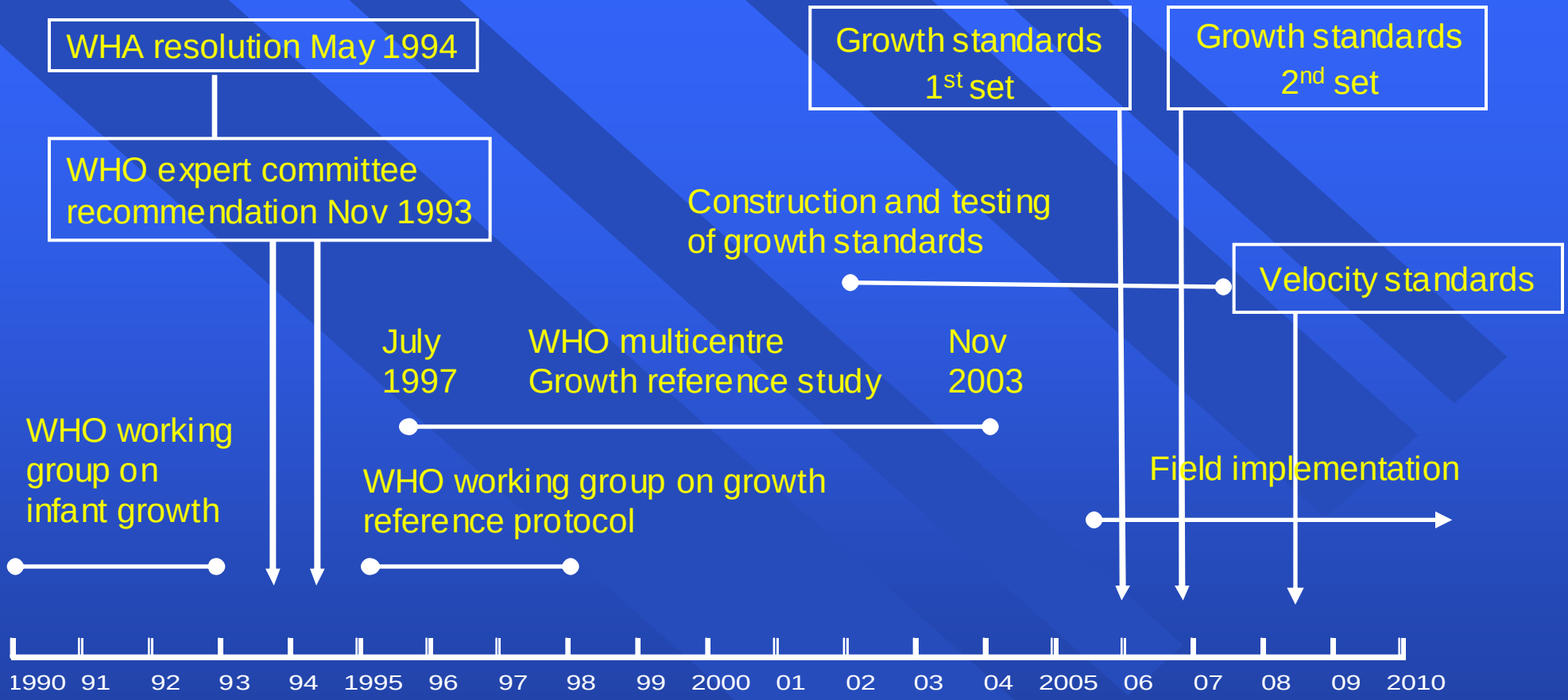
WHO Child Growth Standards Timeline



Growth Standards 1st set: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height, BMI-for-age and motor development indicators

Growth Standards 2nd set: Head circumference-for-age, arm circumference-for-age, triceps skinfold-for-age and subscapular skinfold-for-age

Rationale for the Development of a New International Growth Reference

The previous NCHS/WHO international reference was inappropriate for assessing nutritional status:

- Individual infants

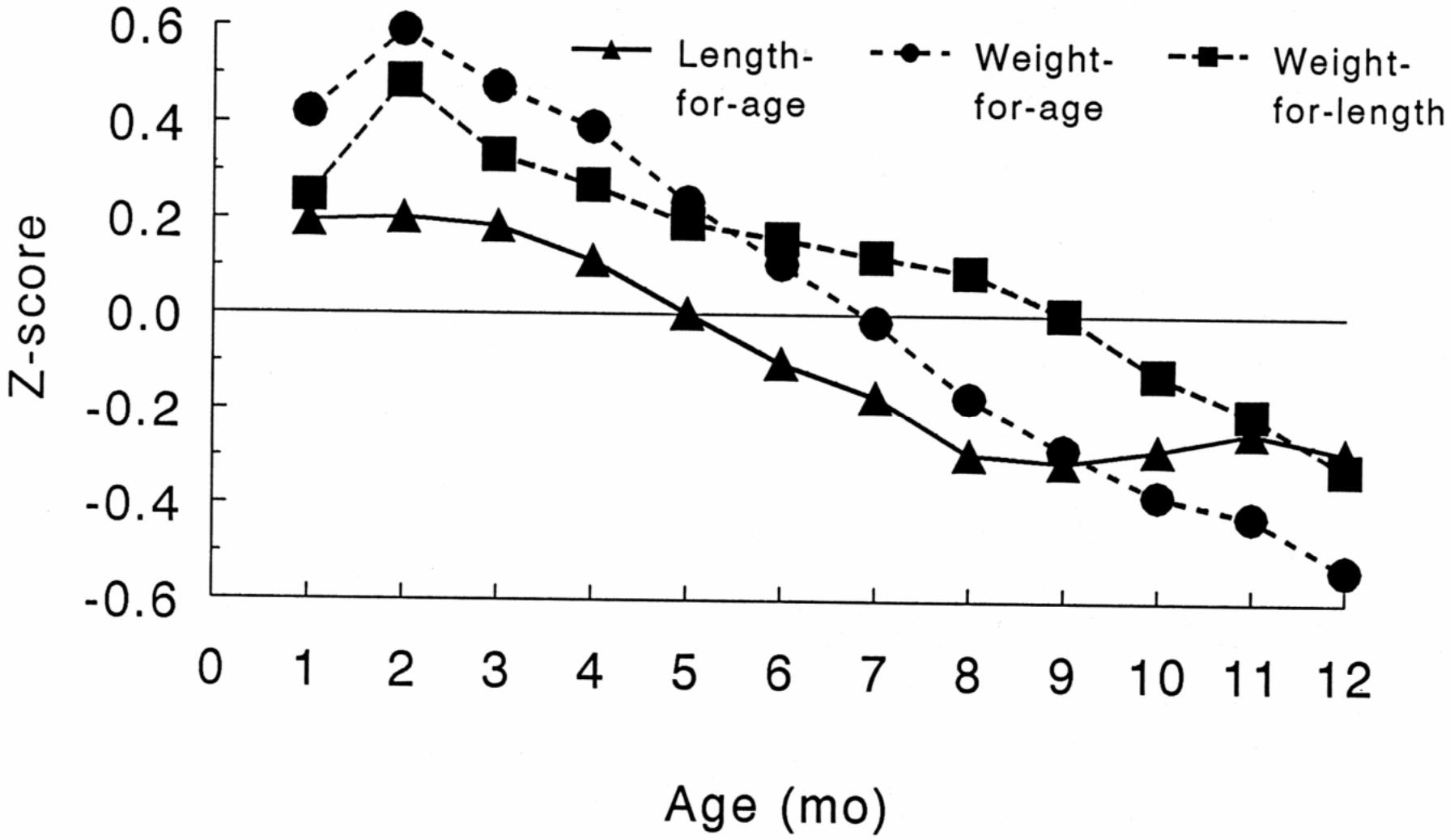
  Interfered with sound nutritional management of breastfed infants thus increasing risk of morbidity and mortality

- Populations

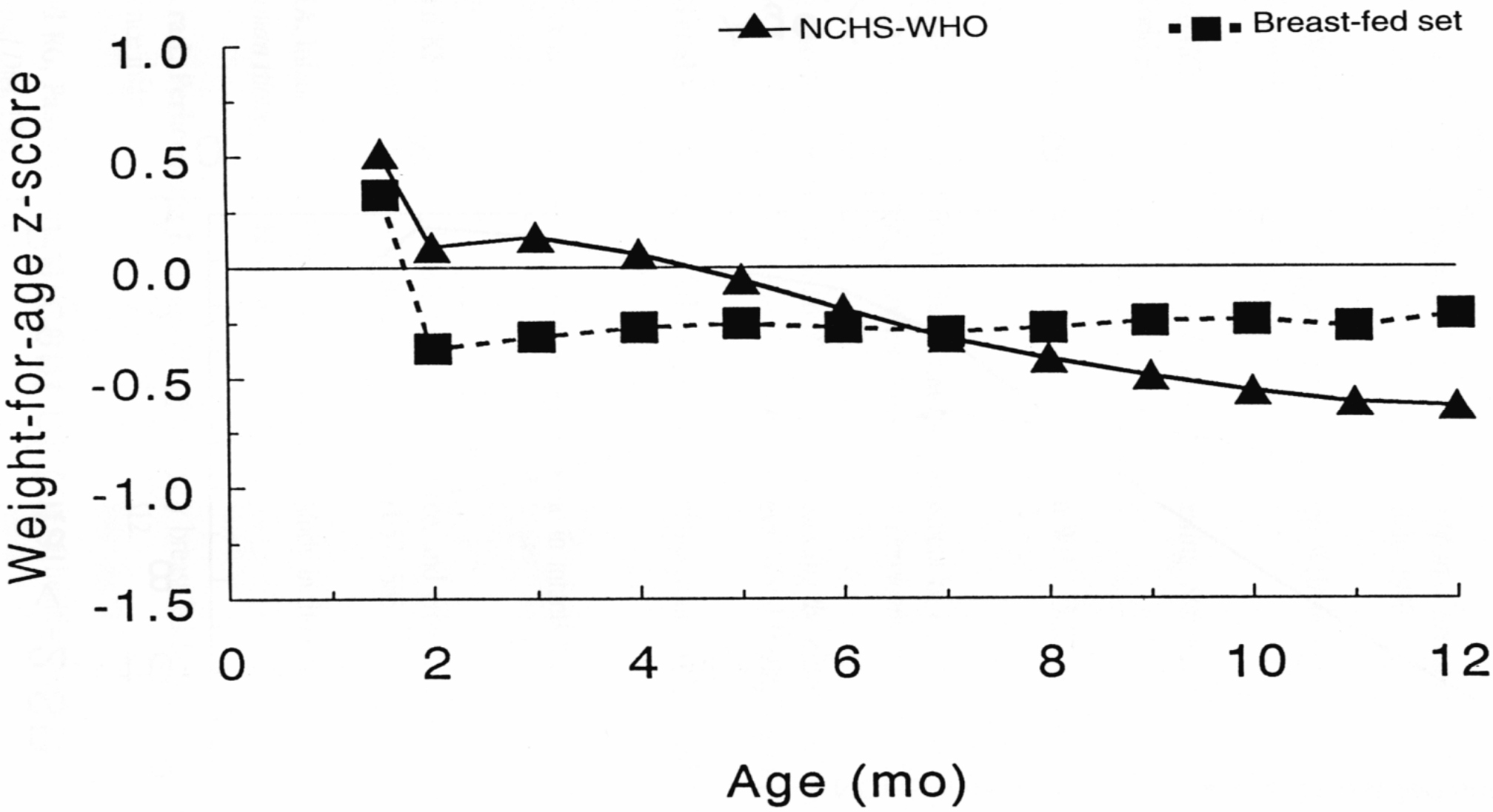
  Provided inaccurate community estimates of under- and over- nutrition

WHO Multicentre Growth Reference Study

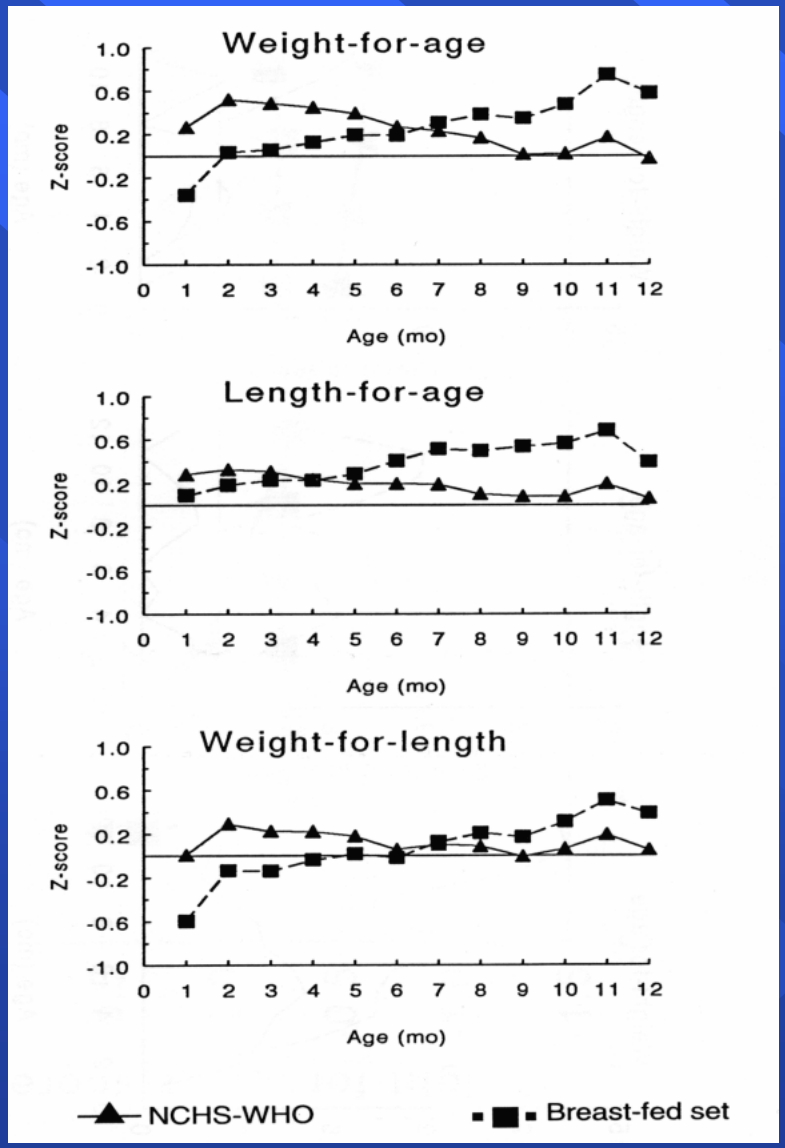
Z-Scores of Breastfed Infants



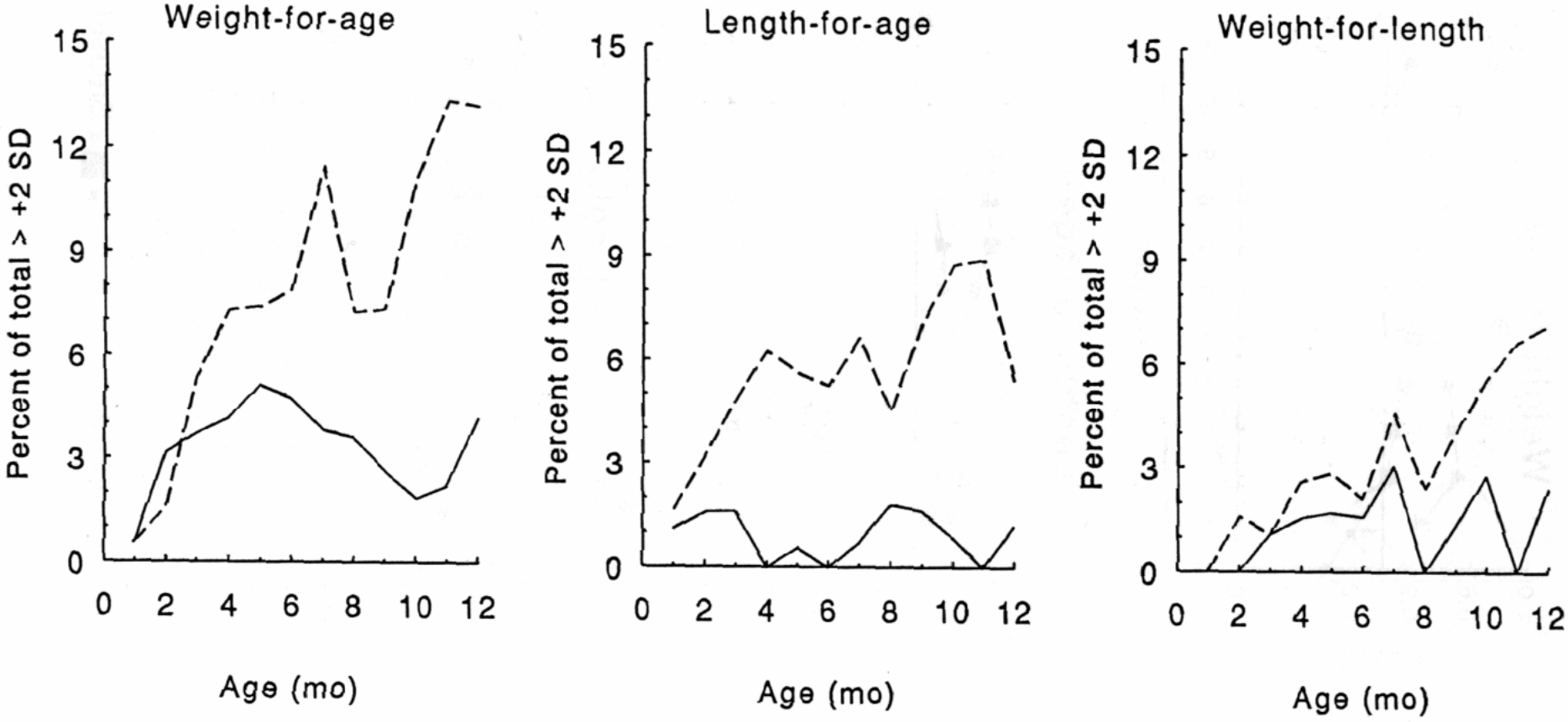
Comparisons Based on HRP Populations



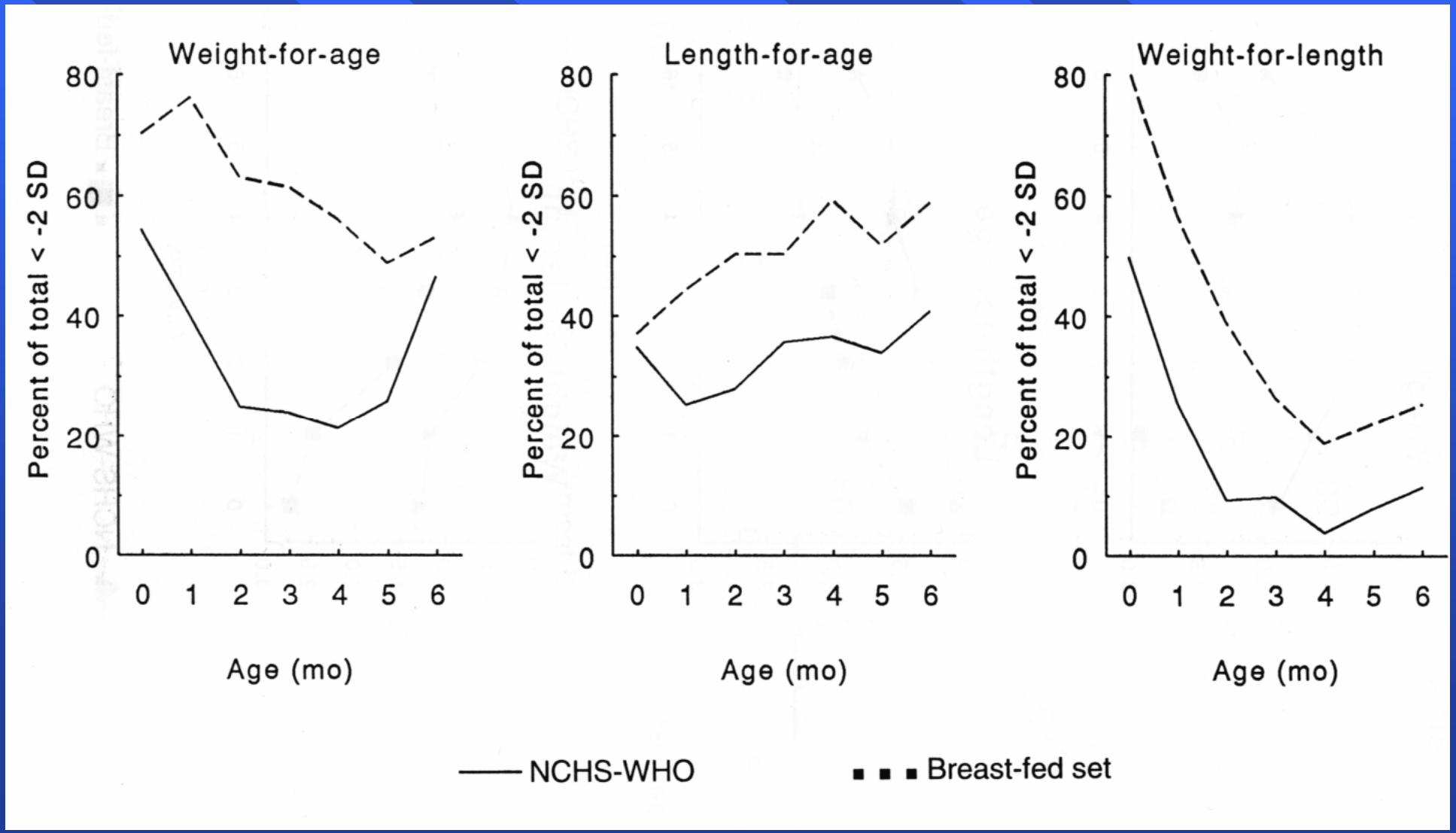
Z-Scores of Formula Fed Infants



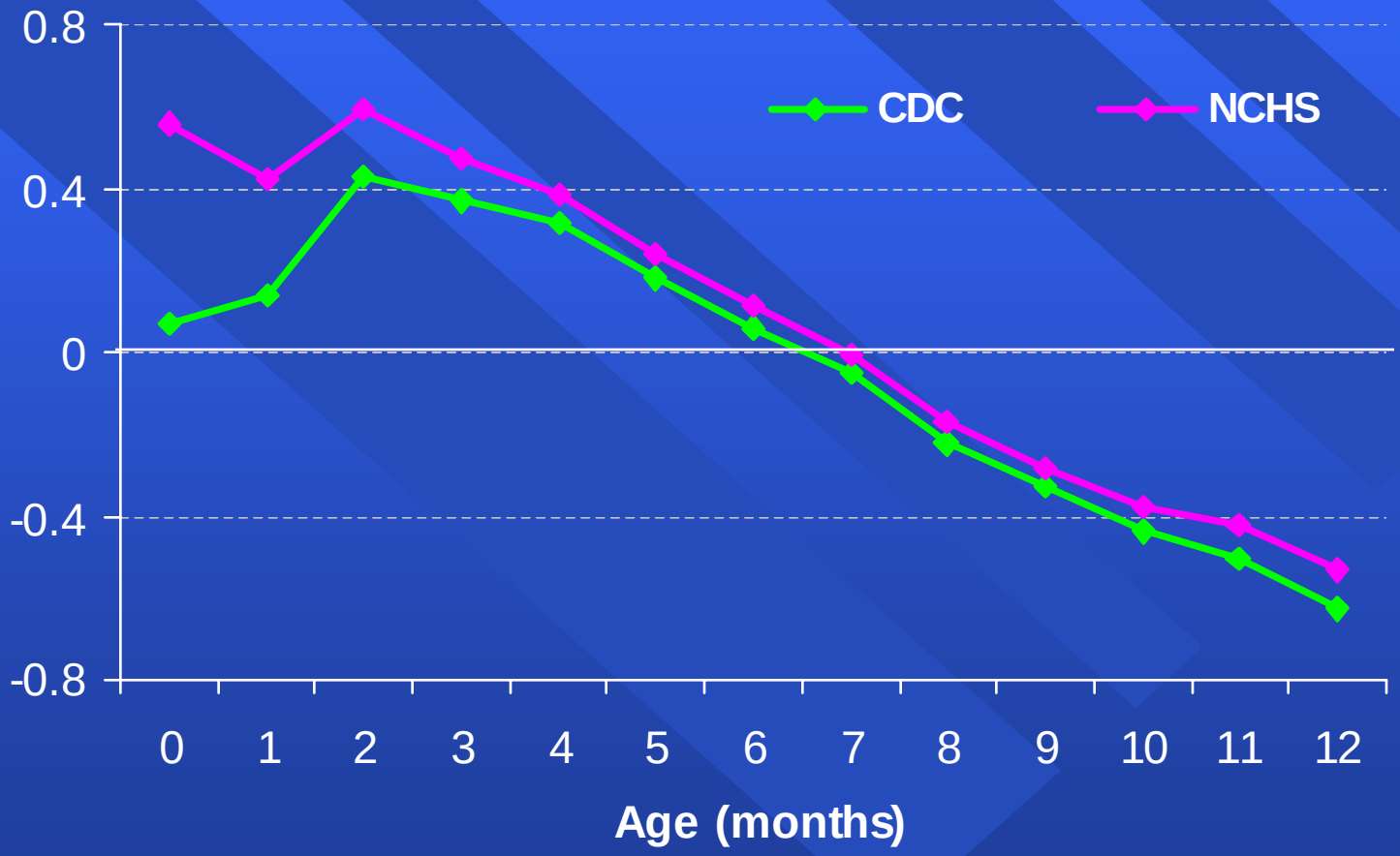
Consequences of Shifting Standard Deviations



Consequences of Shifts in Standard Deviations: Rural Indians



Mean weight-for-age z-scores of breastfed infants relative to the NCHS and CDC references



Source: de Onis & Onyango. Acta Paediatrica 2003; 92:413-419

Growth Reference Study Prescriptive Approach:

Reference v Standard

- Optimal Nutrition
  - Breastfed infants
  - Appropriate complementary feeding
- Optimal Environment
  - No microbiological contamination
  - No smoking
- Optimal Health Care
  - Immunization
  - Pediatric routines

Optimal Growth

WHO Multicentre Growth Reference Study

WHO International Growth Standard

The WHO Multicentre Growth Reference Study

Designed to describe how children ***SHOULD*** grow regardless of time or place

Not ***HOW*** children grow at a particular time or place

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WHO International Growth Standard

Site selection Process

Ghana, India and Oman:

Surveys to identify socio-economic characteristics for selection of individuals whose growth was not unlikely to be environmentally constrained (e.g. parental education and income levels)

Brazil, Norway and the USA

Pre-existing survey data used

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Construction of Growth Curves

Rigorous methods yielded high-quality data

- Detailed examination of 30 existing methods, including various distributions and smoothing techniques;
- Selection of a software package flexible enough to allow comparative testing of alternative methods and the generation of standards;
- Systematic application of the selected approach to the data to generate models that resulted in best fit
- Ongoing statistical review by external expert panel

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Construction of Growth Curves (2)

- Final model: the Box-Cox power exponential method (that accommodates various types of distributions) with curve smoothing by cubic splines
- Except for length/height-for-age that followed a normal distribution, all other standards were adjusted for skewness but not kurtosis
- Diagnostic tools were applied to detect possible biases in estimated percentiles
- The fit between smoothed curves and empirical data was excellent and free of bias, indicating that the resulting curves were a true description of physiological growth experienced by healthy children
- Statistics in Medicine paper and WHO Technical Report

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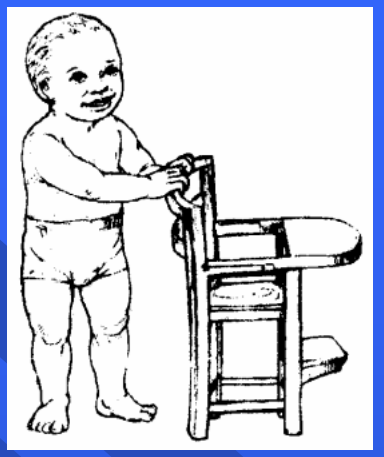
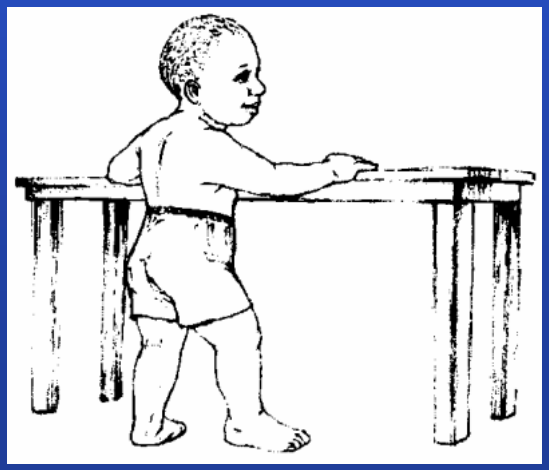
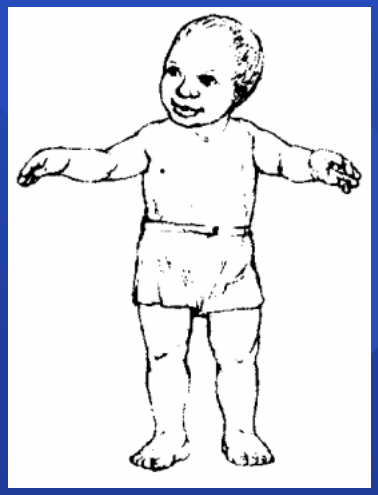
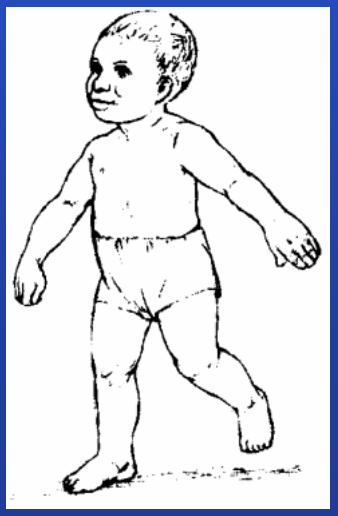


WHO Multicentre Growth Reference Study

Motor Development Assessment





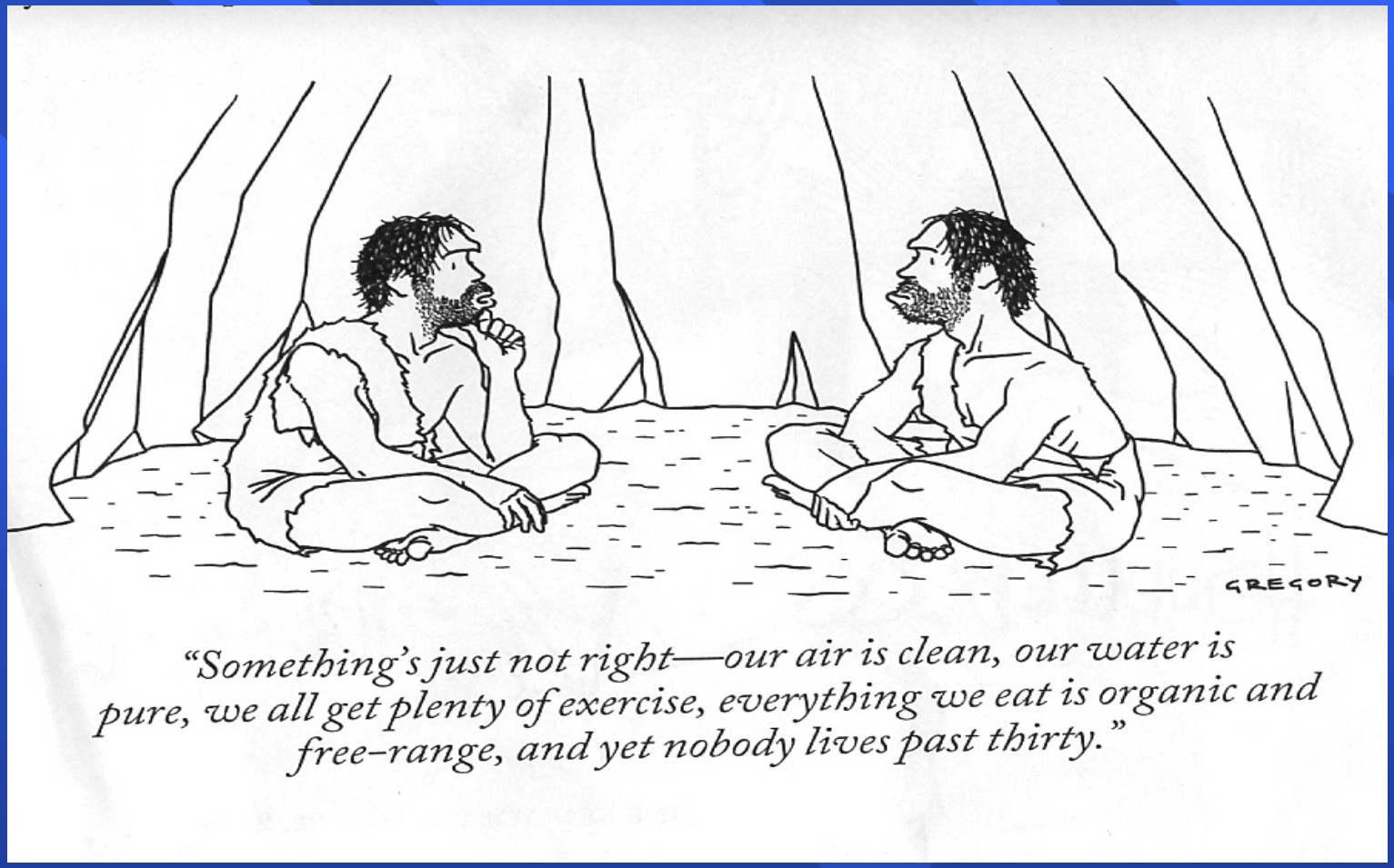


Strategy for Promoting Healthy Growth and Development

Development of a sound international growth reference → Training on its appropriate uses and interpretation → Clinical, Home and Public Health Interventions

WHO Multicentre Growth Reference Study

WHO International Growth Standard



"Something's just not right—our air is clean, our water is pure, we all get plenty of exercise, everything we eat is organic and free-range, and yet nobody lives past thirty."

Ref: New Yorker Magazine

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MGRS: Assessment of Differences in Linear Growth Among Populations in the WHO Multicentre Growth Reference Study

Aim: Assess differences in length

Methods: The following were evaluated,

- Variability of length attributable to sites and individuals,
- Differences in length/height among sites,
- Impact of excluding single sites on the percentiles of the remaining pooled sample

Results: Proportion of total variability attributable to sites and individuals within sites were 3% and 70% respectively

Differences between pooled values and values corresponding to individual sites ranged from -0.33 to + 0.49 SDs (length) and -0.41 to + 0.49 SDs for height

WHO Multicentre Growth Reference Group. Assessment of differences in linear growth among populations in the WHO Multicentre Growth Reference Study. Acta Paedia. 95(Supplement 450):56-65, 2006.

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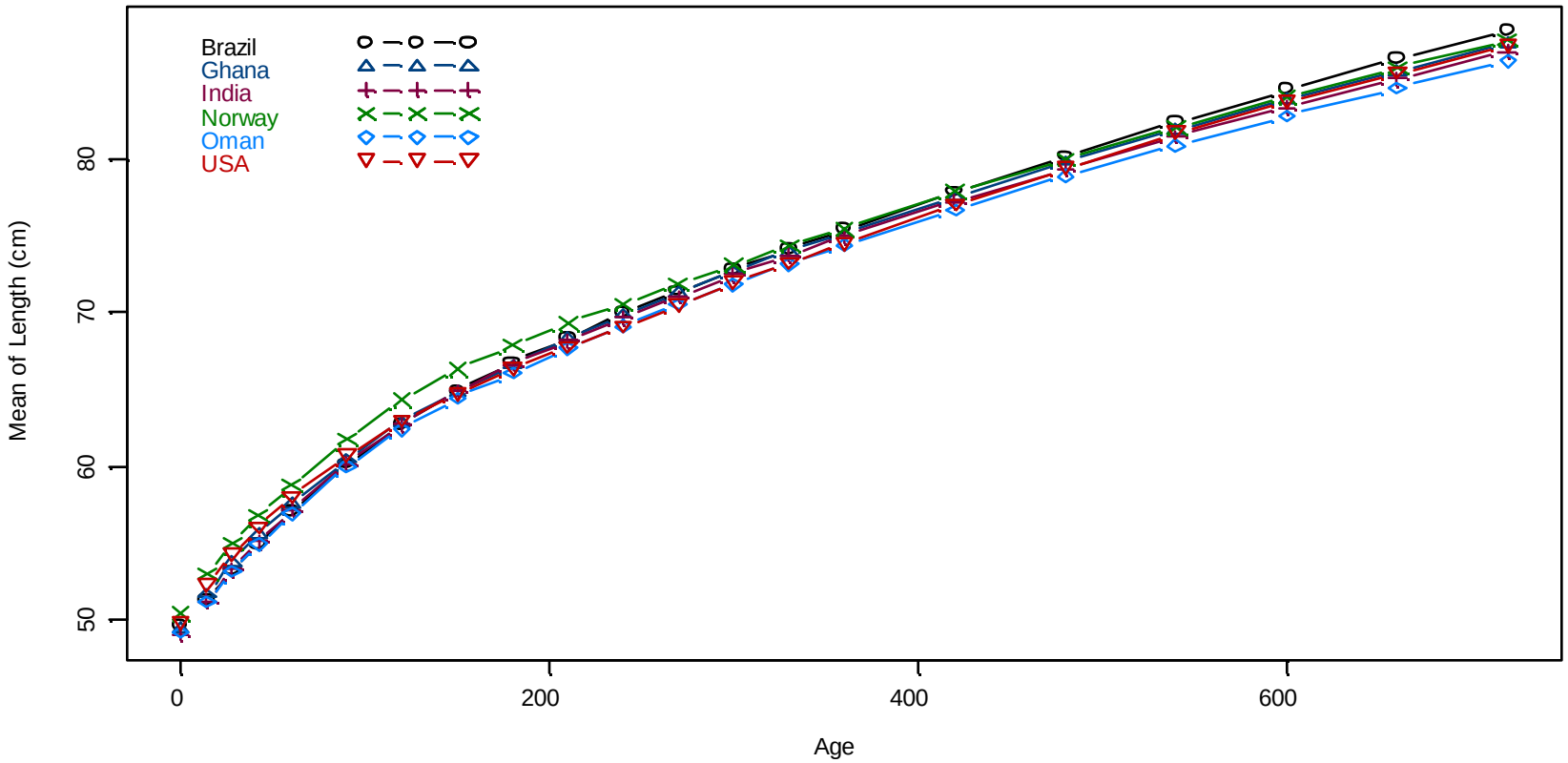
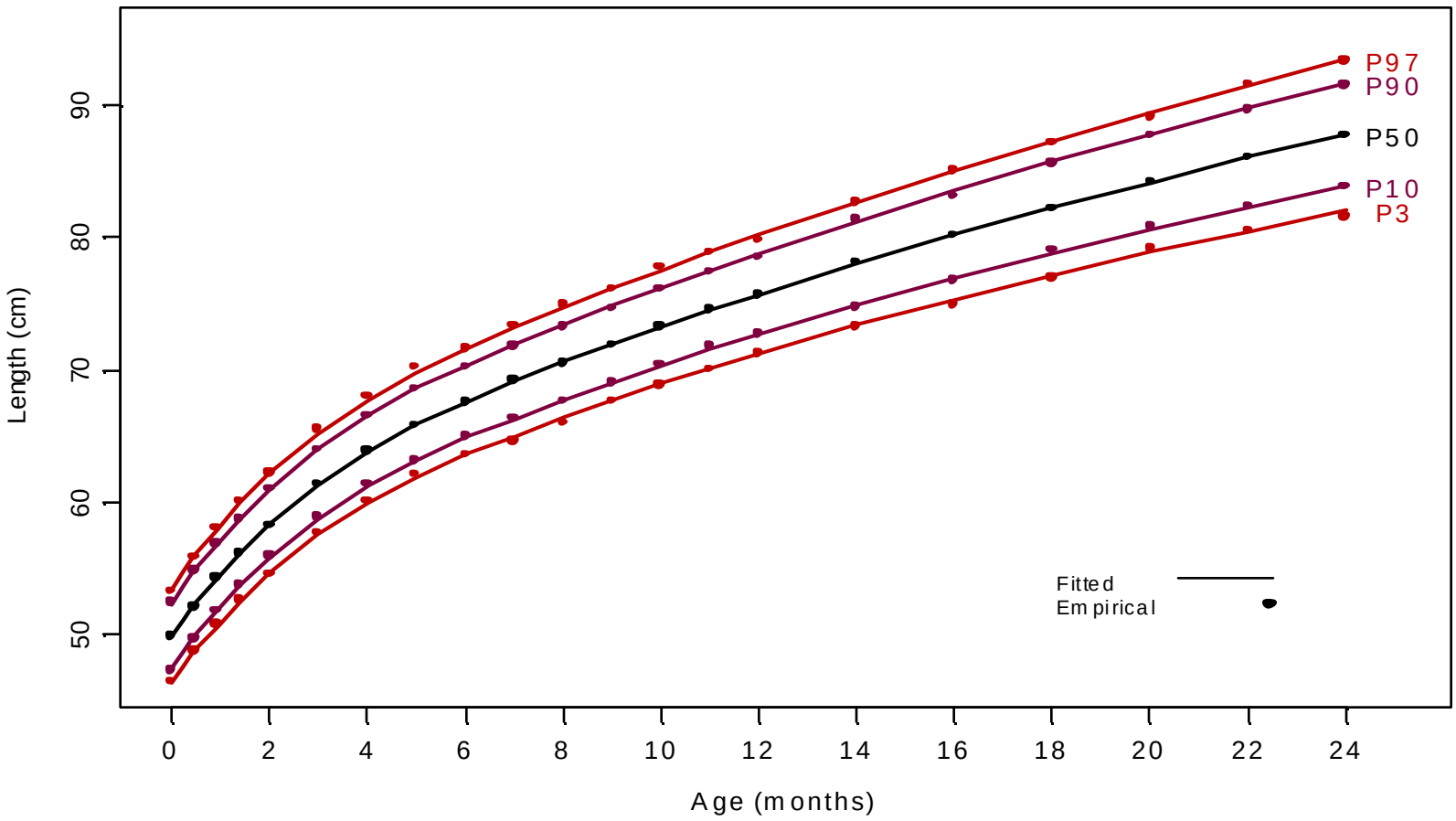
Mean Lengths from Birth to 24 Months at Each of the MGRS Sites

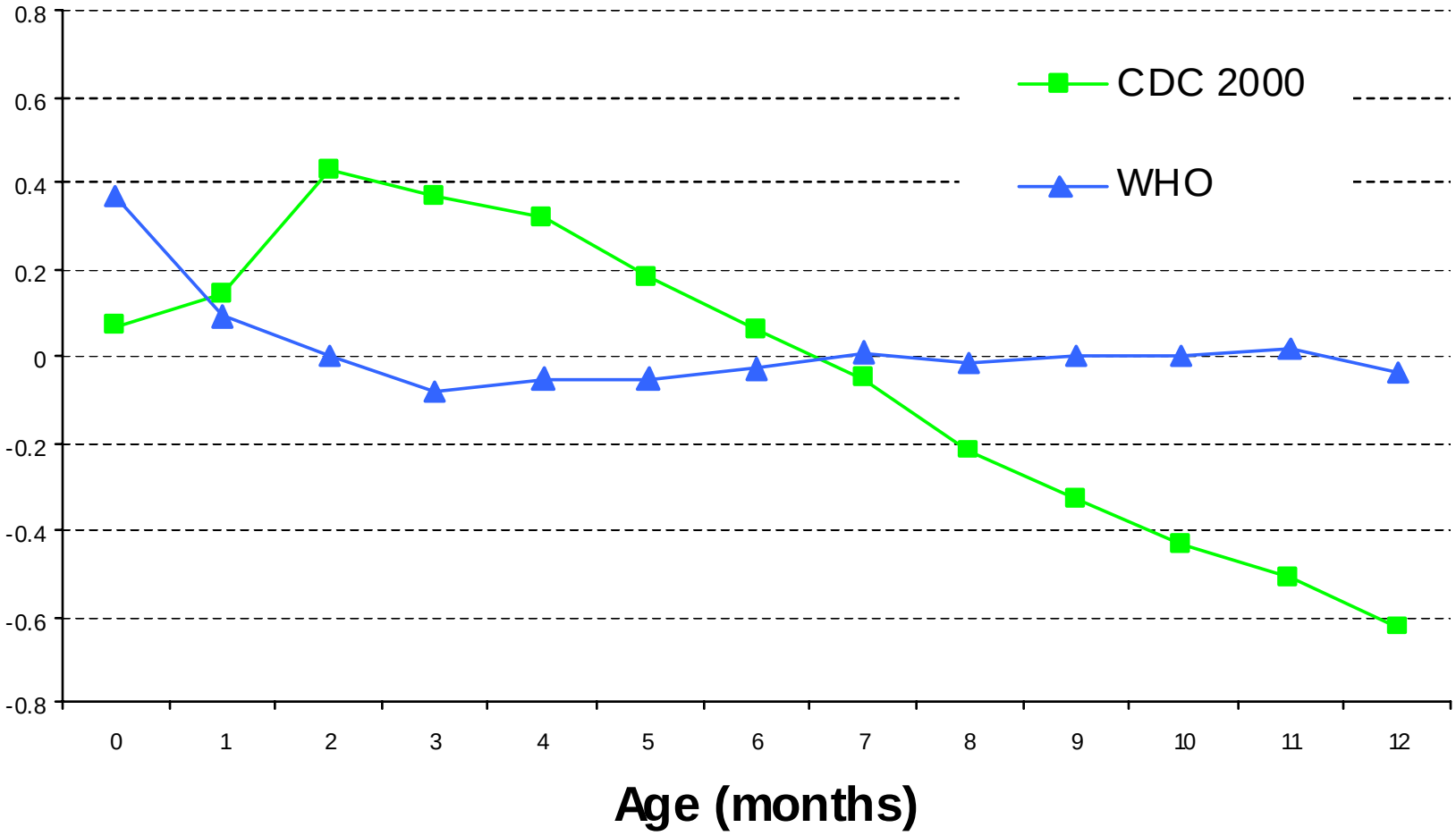


Concordance between smoothed curves and empirical values: Length-for-age, boys, 0-24 months



Source: WHO Multicentre Growth Reference Study Group. WHO Child Growth Standards: Geneva: World Health Organization, 2006.

Mean weight-for-age z-scores of healthy breastfed infants relative to the WHO standards and the CDC 2000 charts



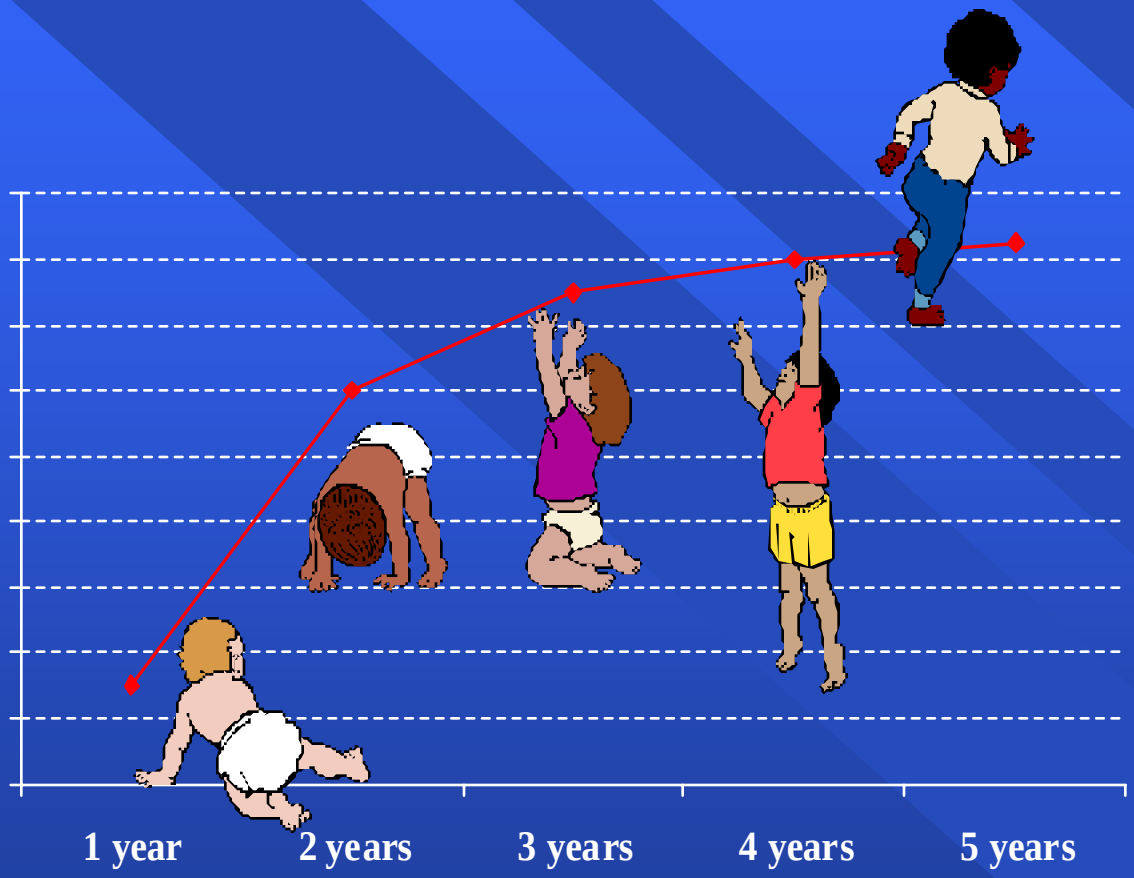
Four Basic Messages

- The MGRS design is highly relevant to contemporary aspirations related to improving the human condition
- The MGRS' anticipated outcomes are of significance to a broad range of economic development and health goals
- The MGRS was implemented well
- The MGRS is a good example of what is achievable when the SCN tripartite members, i.e. UN agencies, bilateral groups, and NGOs, collaborate effectively.

ACKNOWLEDGEMENTS

- All the parents and children who participated
- The principal investigators and their staffs in all six sites
- Dr Mercedes de Onis, MGRS Coordinating Center
- The governments and non government organizations that supported the work.
- The need of your support and assistance in the efficacious implementation of the new standards

WHO International Growth Standard



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