# Methodological issues in the use of anthropometry for evaluation of nutritional status

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King Size
12x1kg
Nestlé
CHOCOLIM

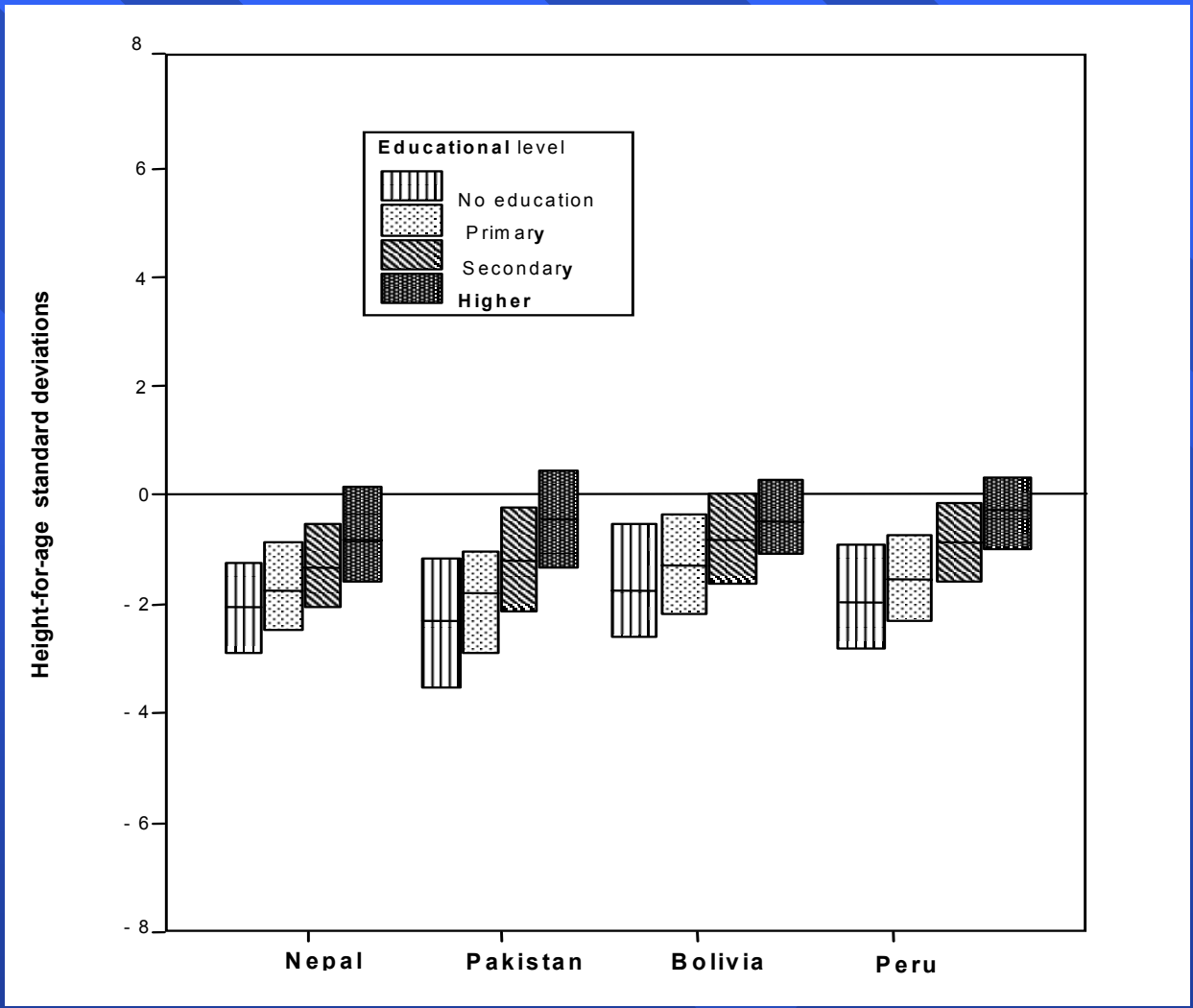

ADULT BLANKET
B-37

# Time schedule child anthropometry

| Measurement | Time frame | Frequency | No. of visits |
|---|---|---|---|
| Weight, length, head circumference | Birth | Once | 1 |
| | Weeks 2-8 | Bi-weekly | 4 |
| | 3-12 months | Monthly | 10 |
| | 14-24 months | Bi-monthly | 6 |
| Arm circumference Skinfold thicknesses | 3-12 months | Monthly | 10 |
| | 14-24 months | Bi-monthly | 6 |

# Assessing nutritional status of lactating mothers

# Variation of height-for-age according to maternal education




Source: de Onis M. Socioeconomic status and child growth. Int J Epidemiol 2003 (In press)

# Methods in anthropometry

- Anthropometric indicators
- Reference population
- Cut-off points
- Applications of anthropometry

# WHO Global Database on Child Growth and Malnutrition

Department of Nutrition
World Health Organization
Geneva, Switzerland

# Background

- Child growth internationally recognized as an important public health indicator
- Numerous surveys but not comparable
- WHO's systematic standardization of data initiated in 1986

# General objectives

- To establish a global nutritional surveillance system
- To compile, standardize and disseminate results of anthropometric surveys performed worldwide

# Specific objectives

- Characterize nutritional status
- Enable international comparison
- Identify populations in need
- Evaluate interventions
- Monitor secular trends
- Raise political awareness

# Methods: Data standardization

- Use of the NCHS/WHO international reference
- Prevalence of wasting, stunting, underweight and overweight
- Cut-off points in Z-scores: <-2, <-3 and >+2 SD
- Stratification by age, sex, region, urban/rural
- Summary statistics: means & SDs of Z-scores

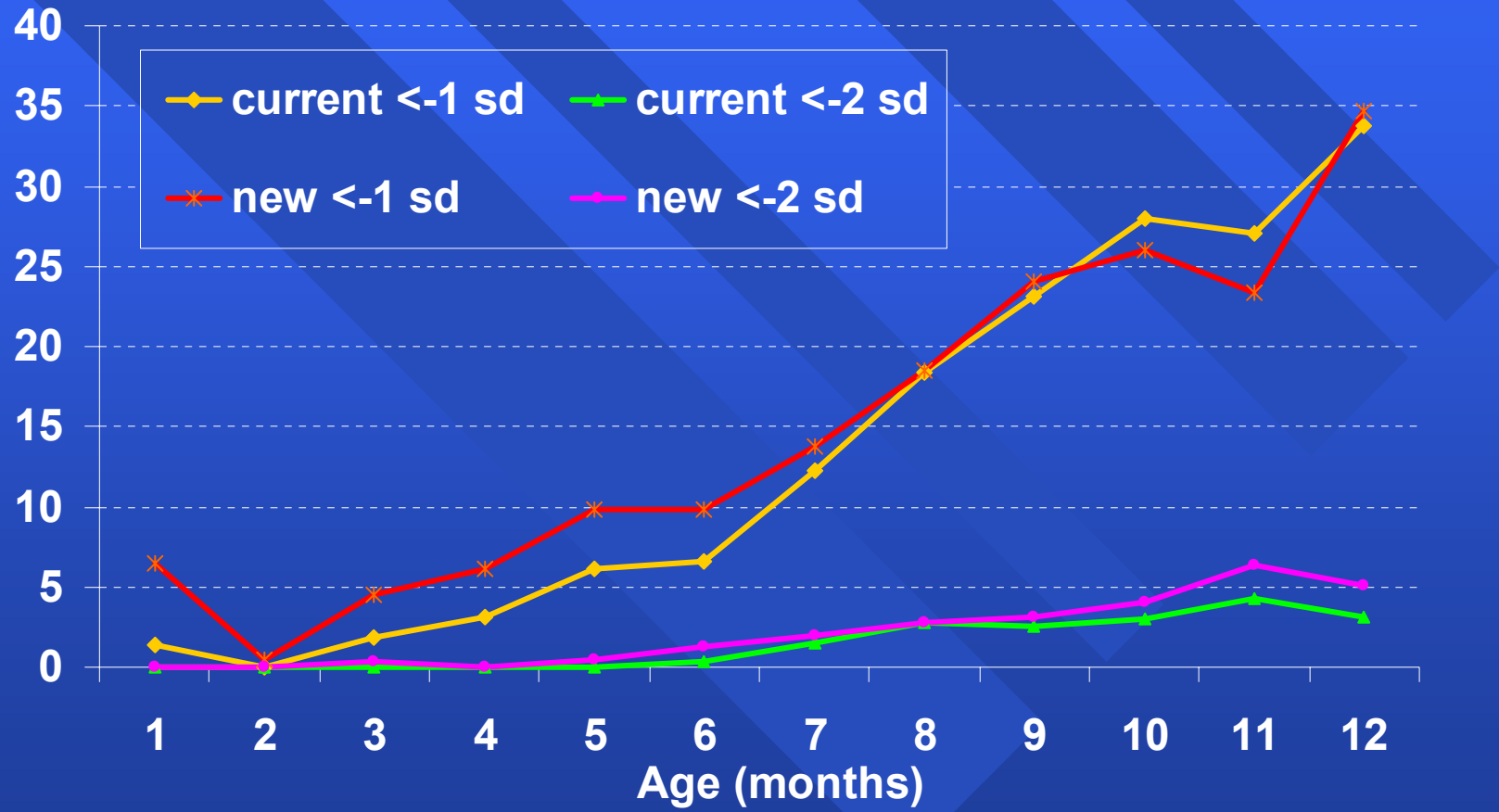
# Anthropometric indicators

- **Attained growth**
  - Length/height-for-age
  - Weight-for-age
  - BMI-for-age
  - MUAC-for-age
  - Head circumference-for-age
  - Subscapular skinfold-for-age
  - Triceps skinfold-for-age
  - Weight-for-height/length
  - MUAC-for-height/length

# Database Indicators

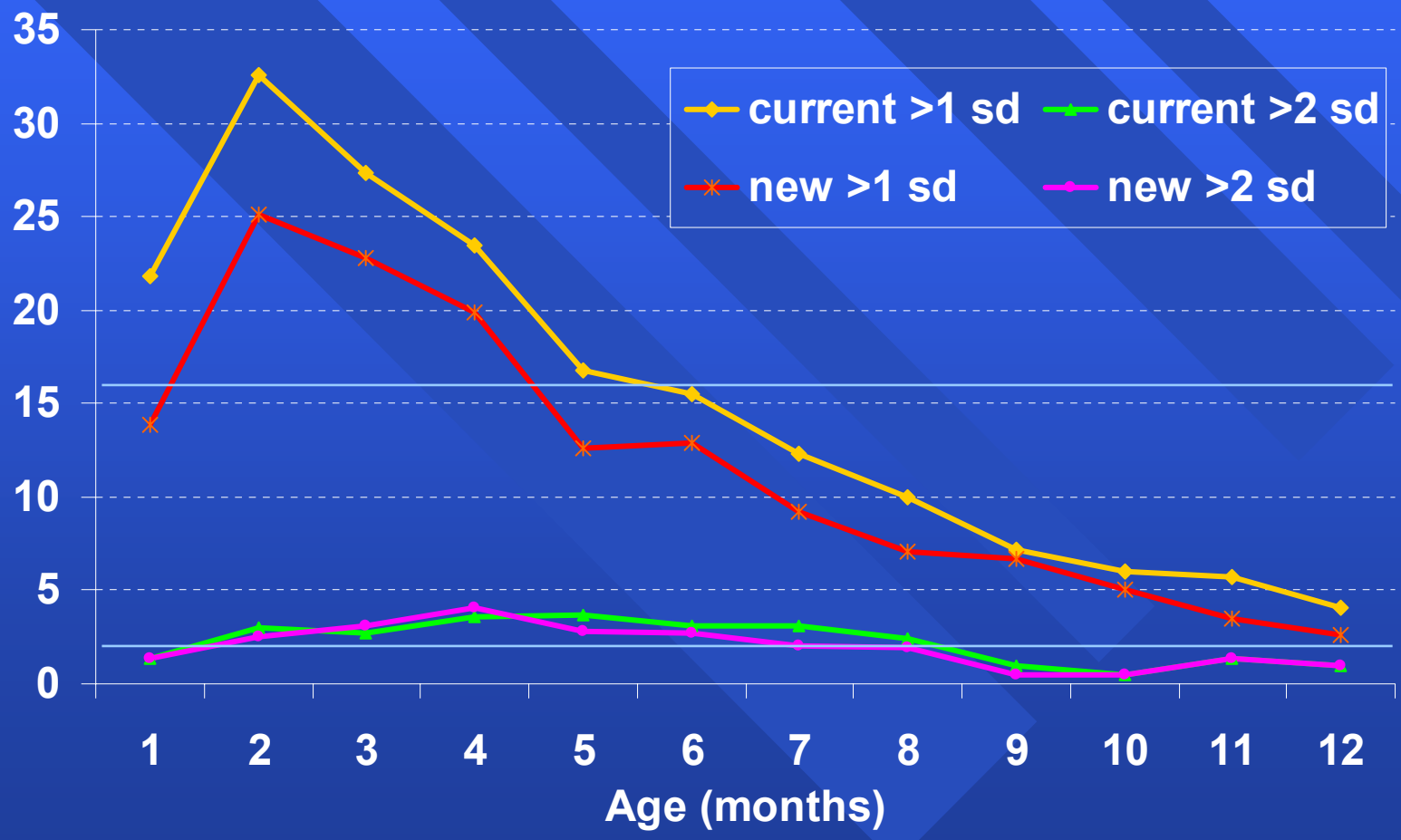
- Wasting or low weight-for-height (cut-offs <-3 and <-2 SD)
- Stunting or low height-for-age (cut-offs <-3 and <-2 SD)
- Underweight or low weight-for-age (cut-offs <-3 and <-2 SD)
- Overweight or high weight-for-height (cut-off >+2 SD)

# Percent below -1 and -2 SD WA



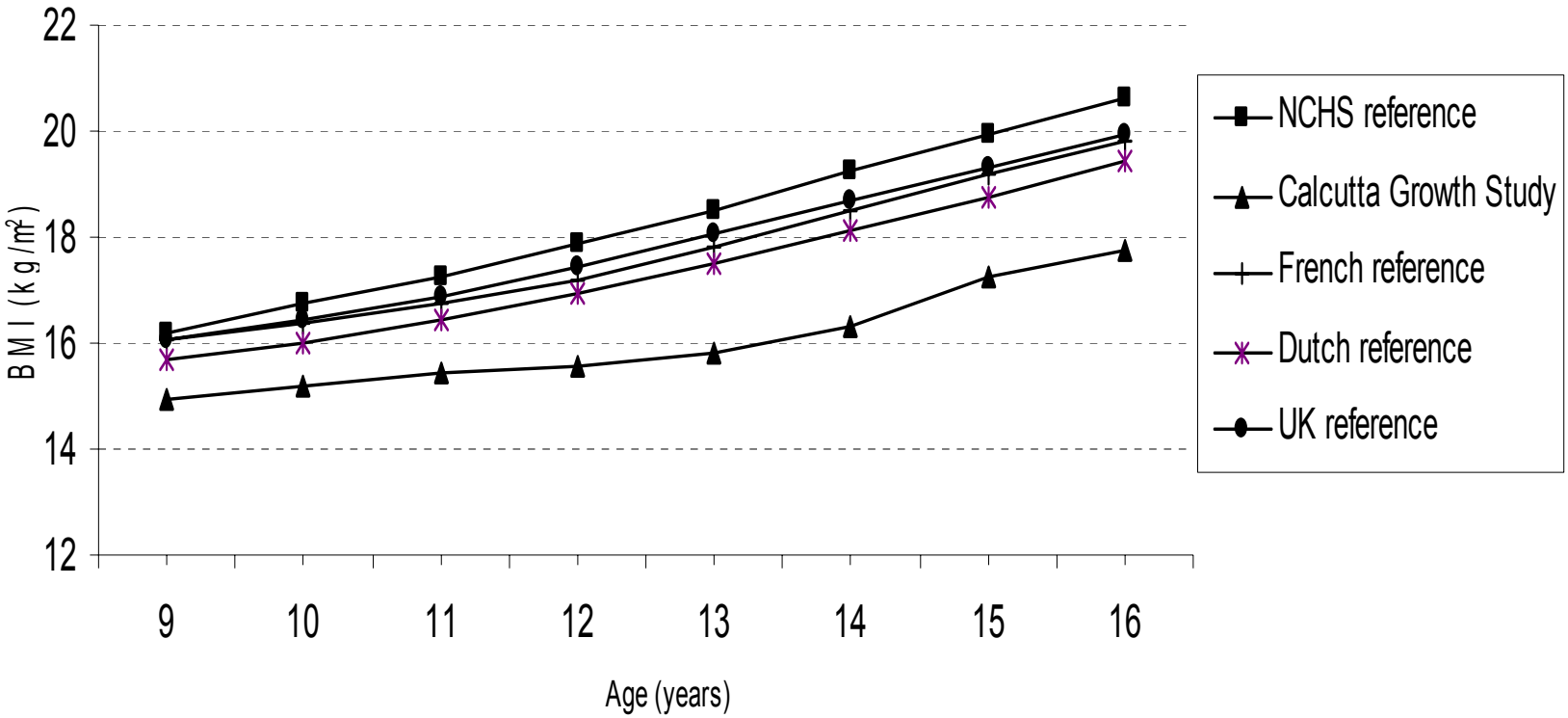

Source: de Onis M, Onyango A. The CDC reference and the growth of breast-fed infants. Acta Paediatrica, 2003 (In press)

# Percent above +1 and +2 SD WA



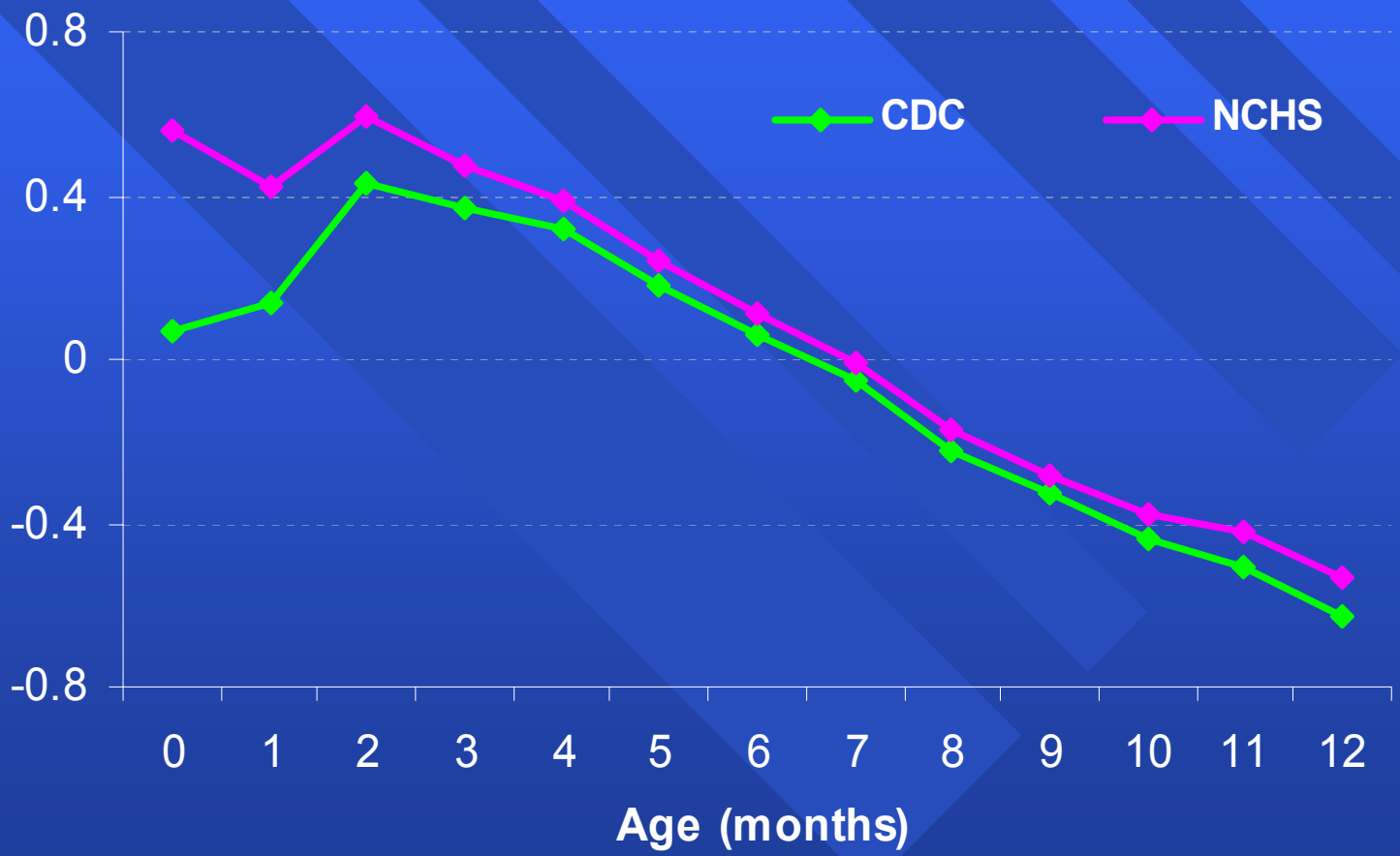

Source: de Onis M, Onyango A. The CDC reference and the growth of breast-fed infants. Acta Paediatrica, 2003 (In press)

# Mean BMI-for-age of the Calcutta boys compared with the French, Dutch, British, and NCHS reference medians



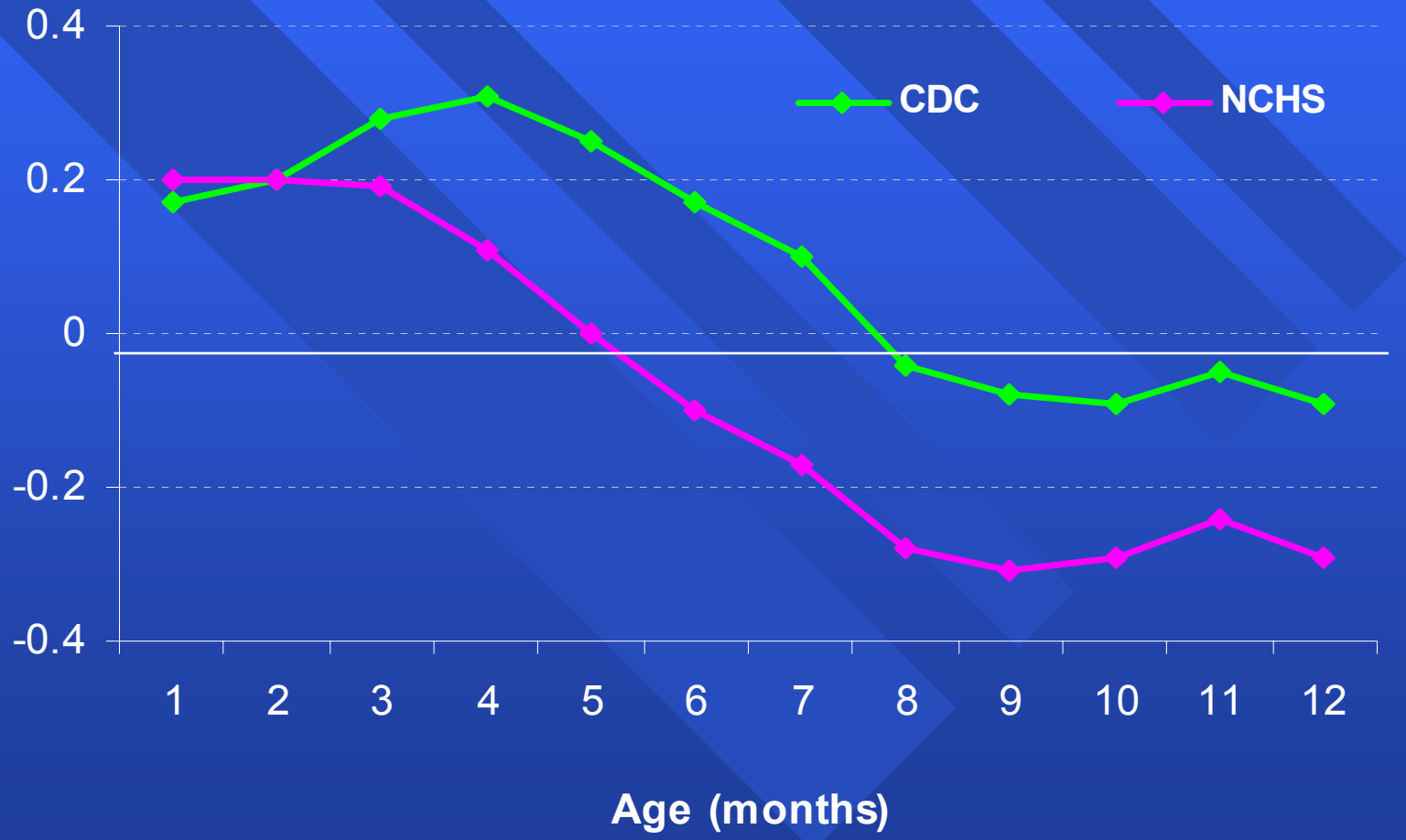

Source: de Onis M, Dasgupta P, Saha S, Sengupta D, Blössner M. The National Centre for Health Statistics reference and the growth of Indian adolescent Boys. American Journal of Clinical Nutrition 2001; 74:248-253

# Mean weight-for-age z-score



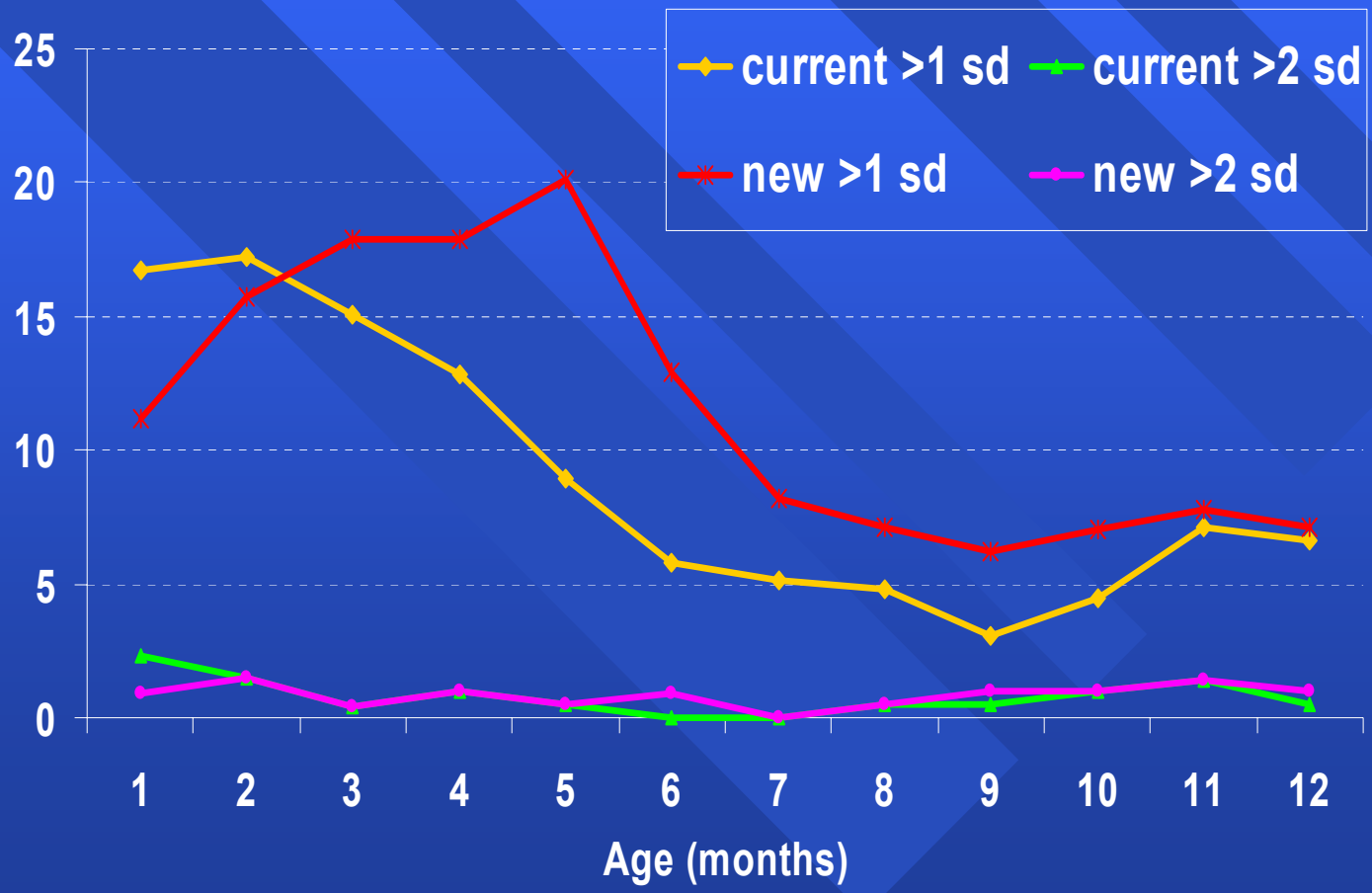

Source: de Onis M, Onyango A. The CDC reference and the growth of breast-fed infants. Acta Paediatrica, 2003 (In press)

# Mean length-for-age z-score



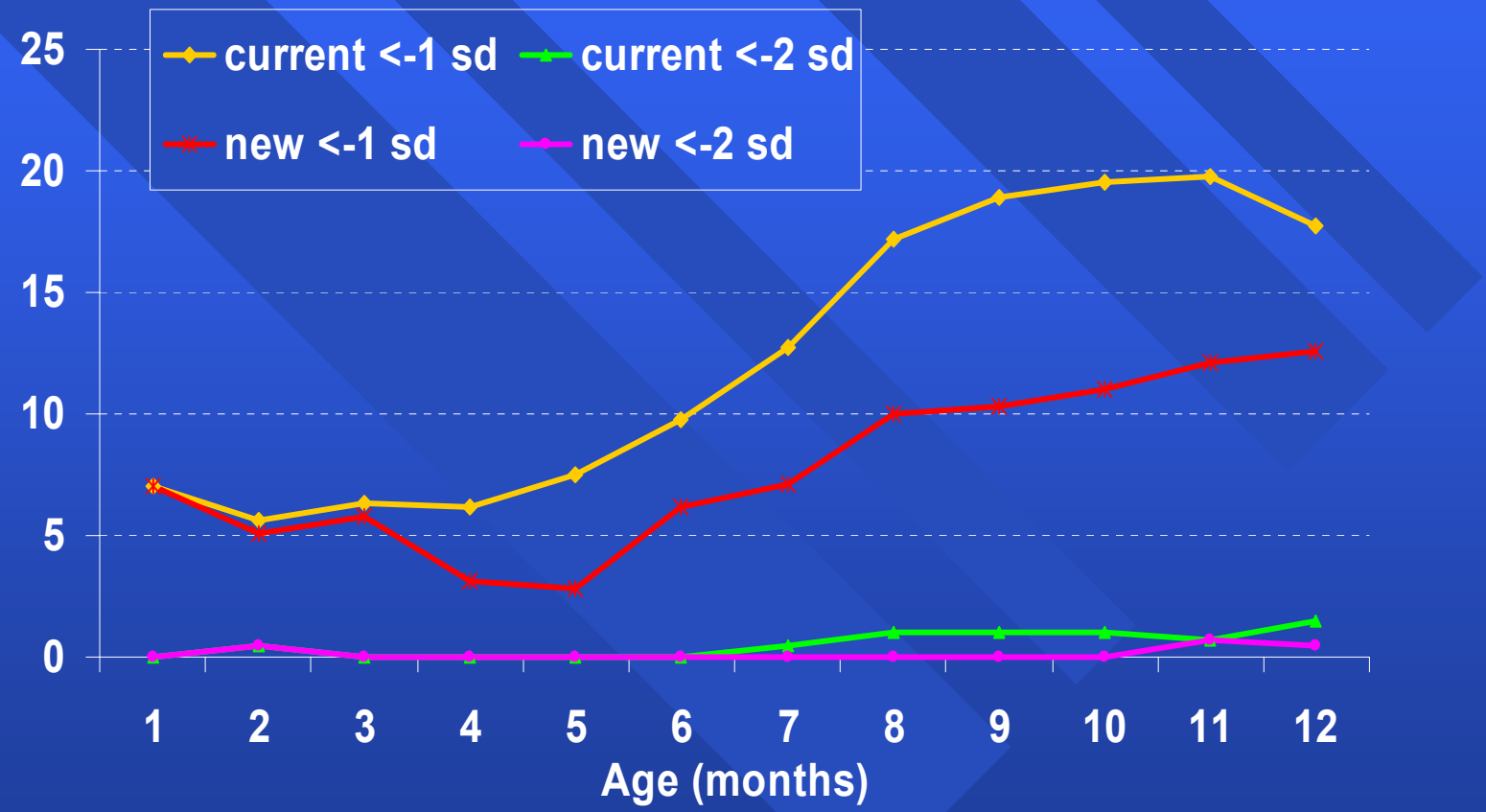

Source: de Onis M, Onyango A. The CDC reference and the growth of breast-fed infants. Acta Paediatrica, 2003 (In press)

# Percent above +1 and +2 SD LA




Source: de Onis M, Onyango A. The CDC reference and the growth of breast-fed infants. Acta Paediatrica, 2003 (In press)

# Percent below -1 and -2 SD LA



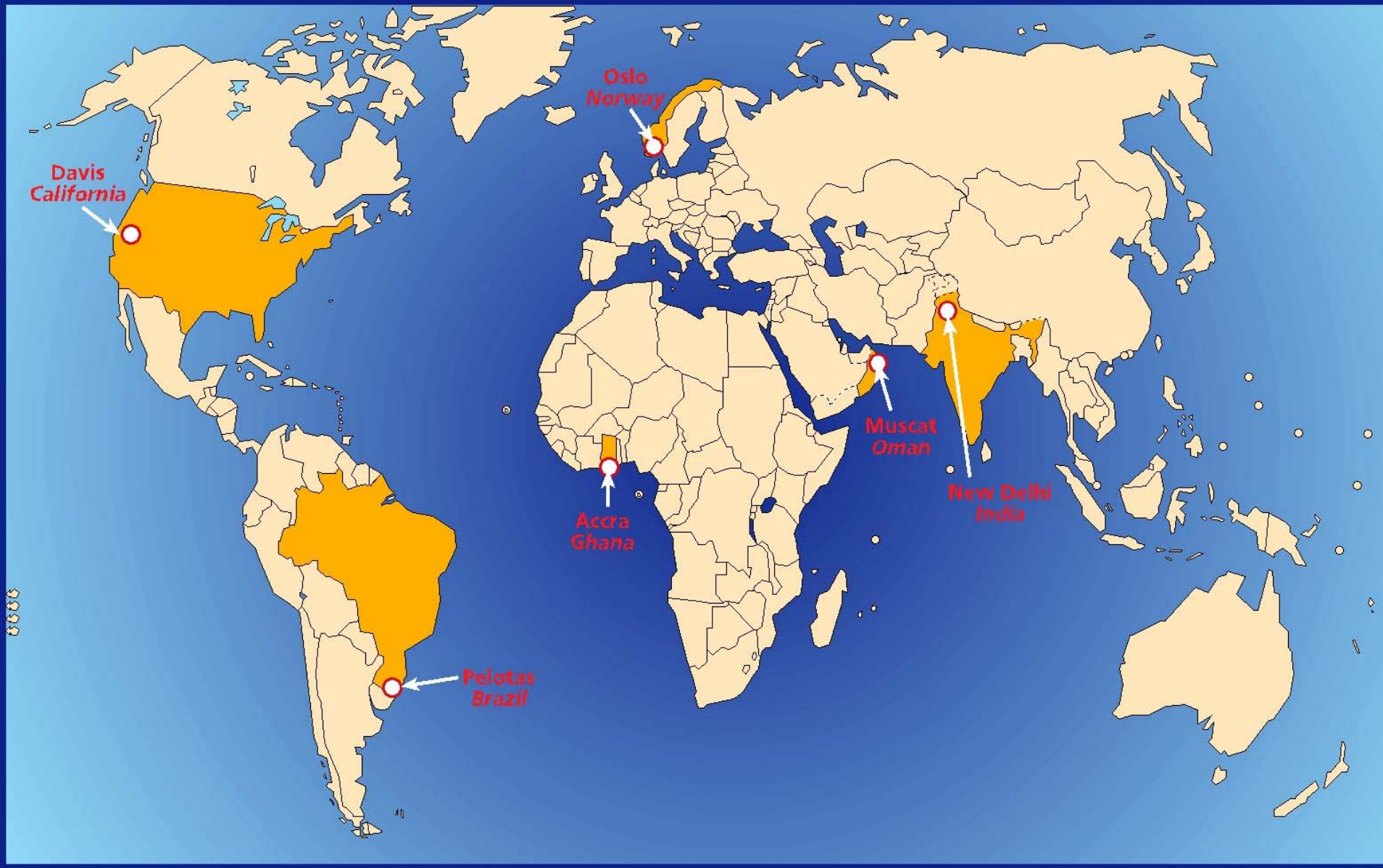

Source: de Onis M, Onyango A. The CDC reference and the growth of breast-fed infants. Acta Paediatrica, 2003 (In press)

# A Growth Curve for the 21st Century

# The WHO Multicentre Growth Reference Study

Nutrition for Health and Development
World Health Organization
Geneva, Switzerland

# WHO MULTICENTRE GROWTH REFERENCE STUDY (MGRS)



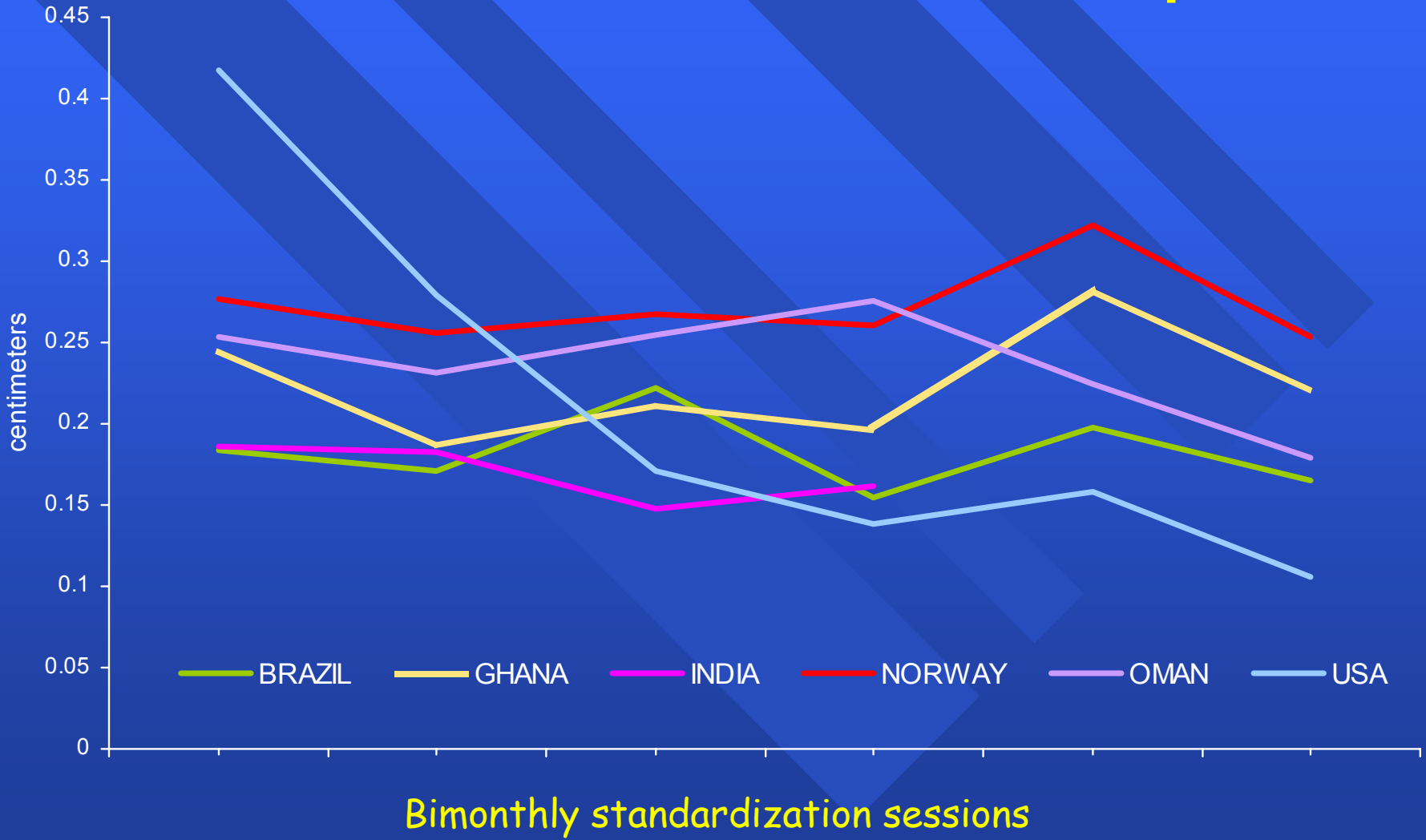
# Main features of the new International Growth Reference

- Prescriptive (versus descriptive) reference
- International sample
- Breastfed infants
- Healthy populations with unconstrained growth

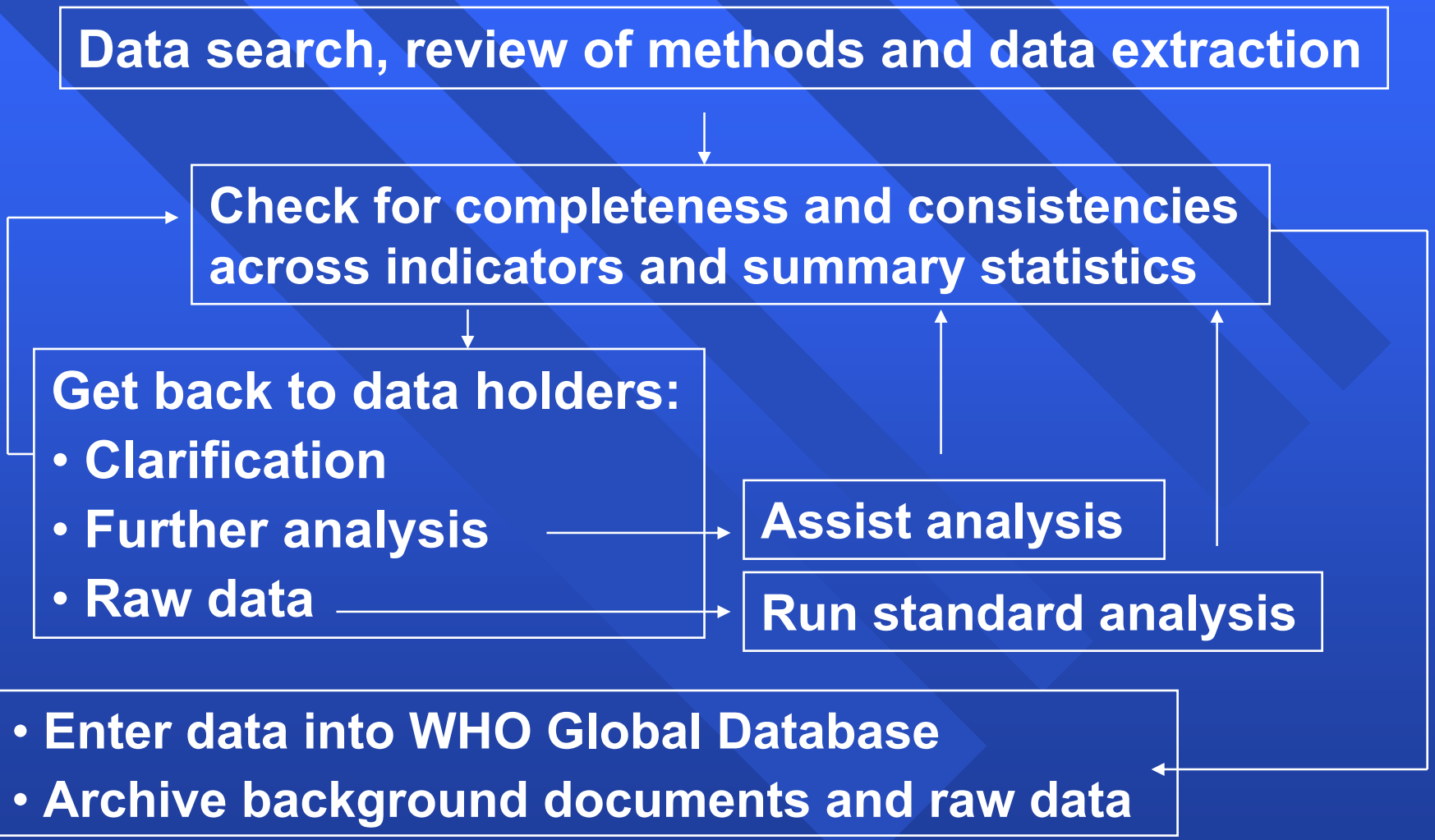
# Anthropometric protocols

- Anthropometric equipment
- Training of field workers
- Standardization sessions
- Measurement techniques
- Quality control during data collection
  (data verification, validation, completeness, etc)

# Technical error of measurement
# Arm circumference - Follow up



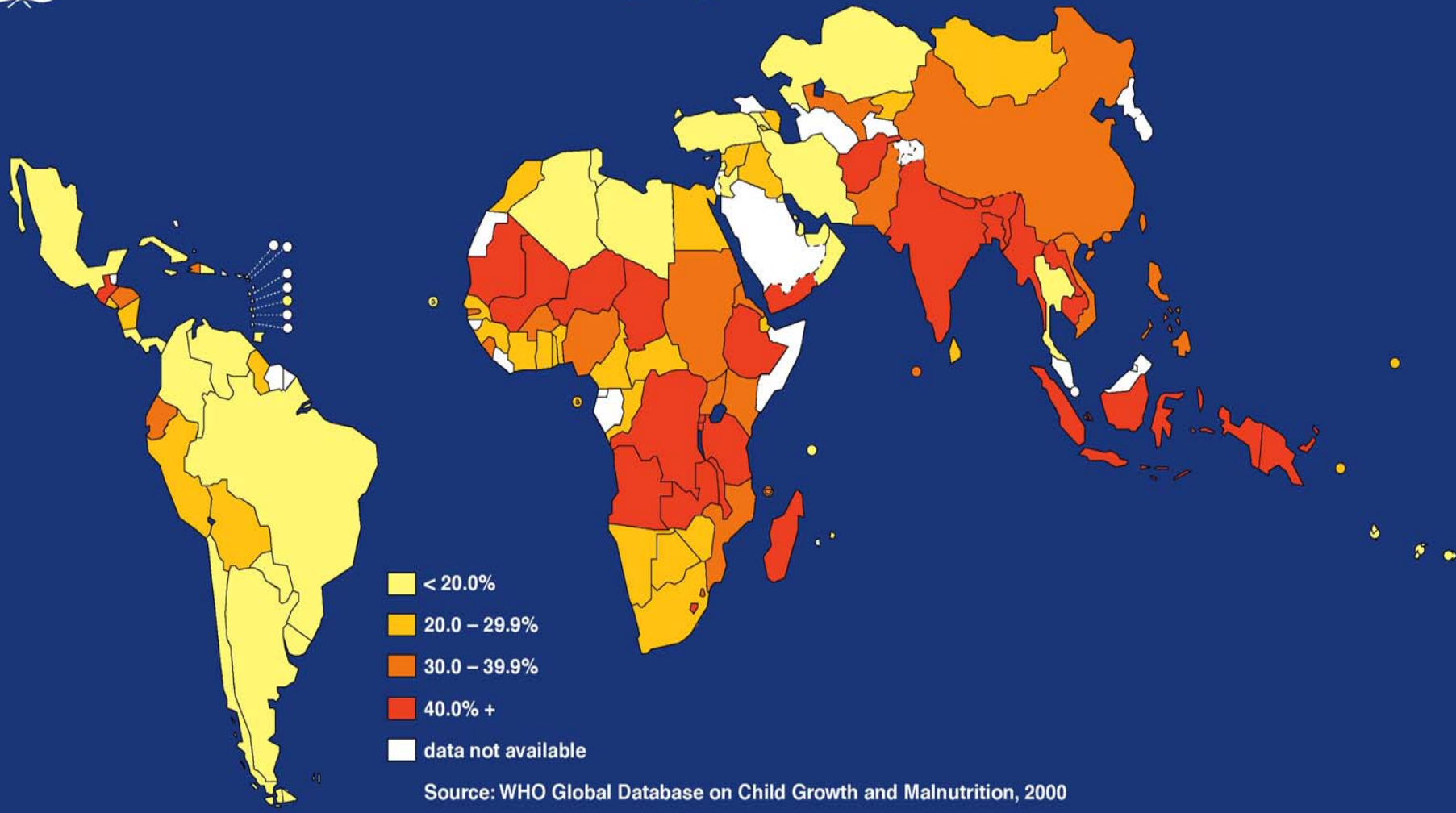
# Database work-flow



# Coverage (May 2002)

- 400 national surveys from 139 countries
- 433 sub-national surveys 155 countries
- 99% children <5 yr in developing countries
- 65% children <5 yr in developed countries
- 2332 references

# Prevalence of stunted children in developing countries




Source: WHO Global Database on Child Growth and Malnutrition, 2000



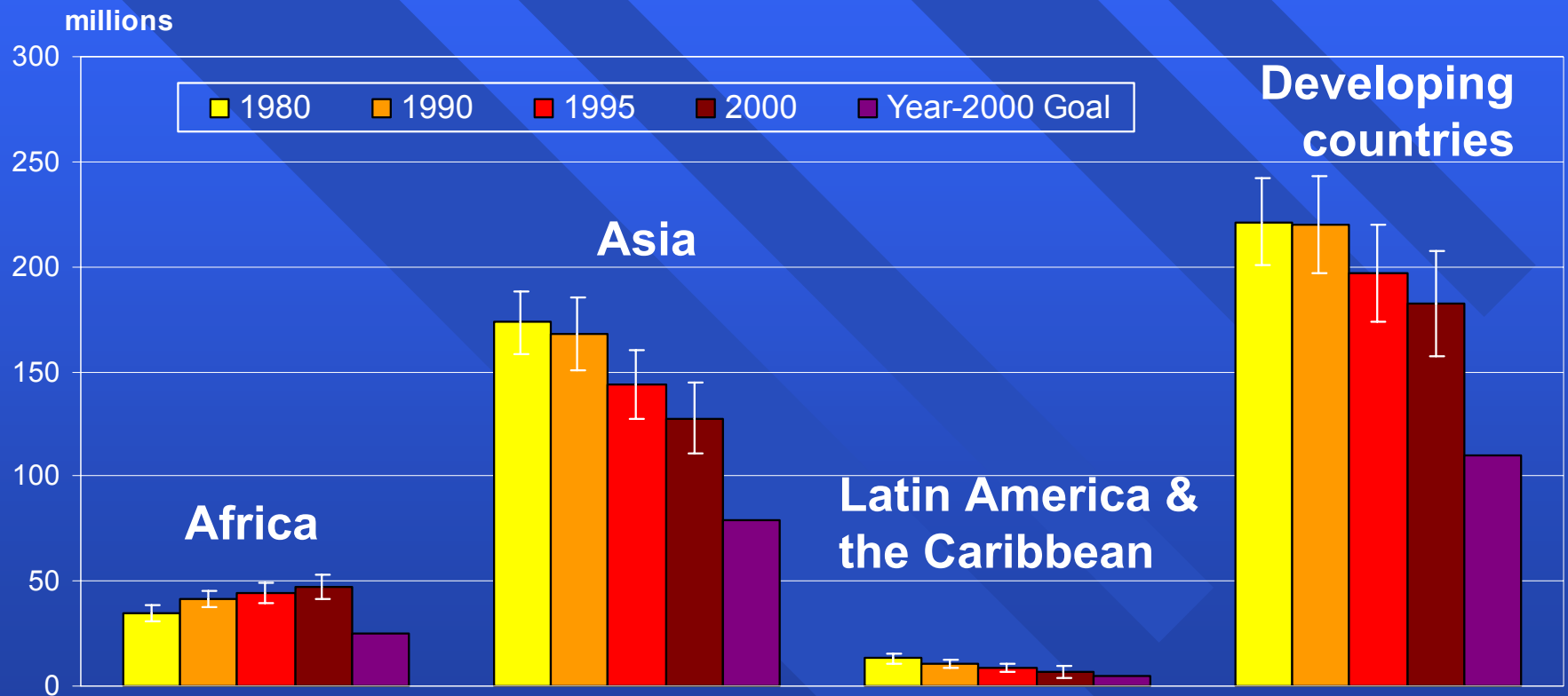
WHO 00287col

# Global and regional estimates of stunted children in 2000

| Region | Stunted children (%) | (millions) |
|---|---|---|
| Africa | 35 | 47 |
| Asia | 34 | 128 |
| Latin America & Caribbean | 13 | 7 |
| All developing countries | 33 | 182 |

Source: de Onis, Frongillo, Blössner. WHO Bull 2000;78:1222-33.

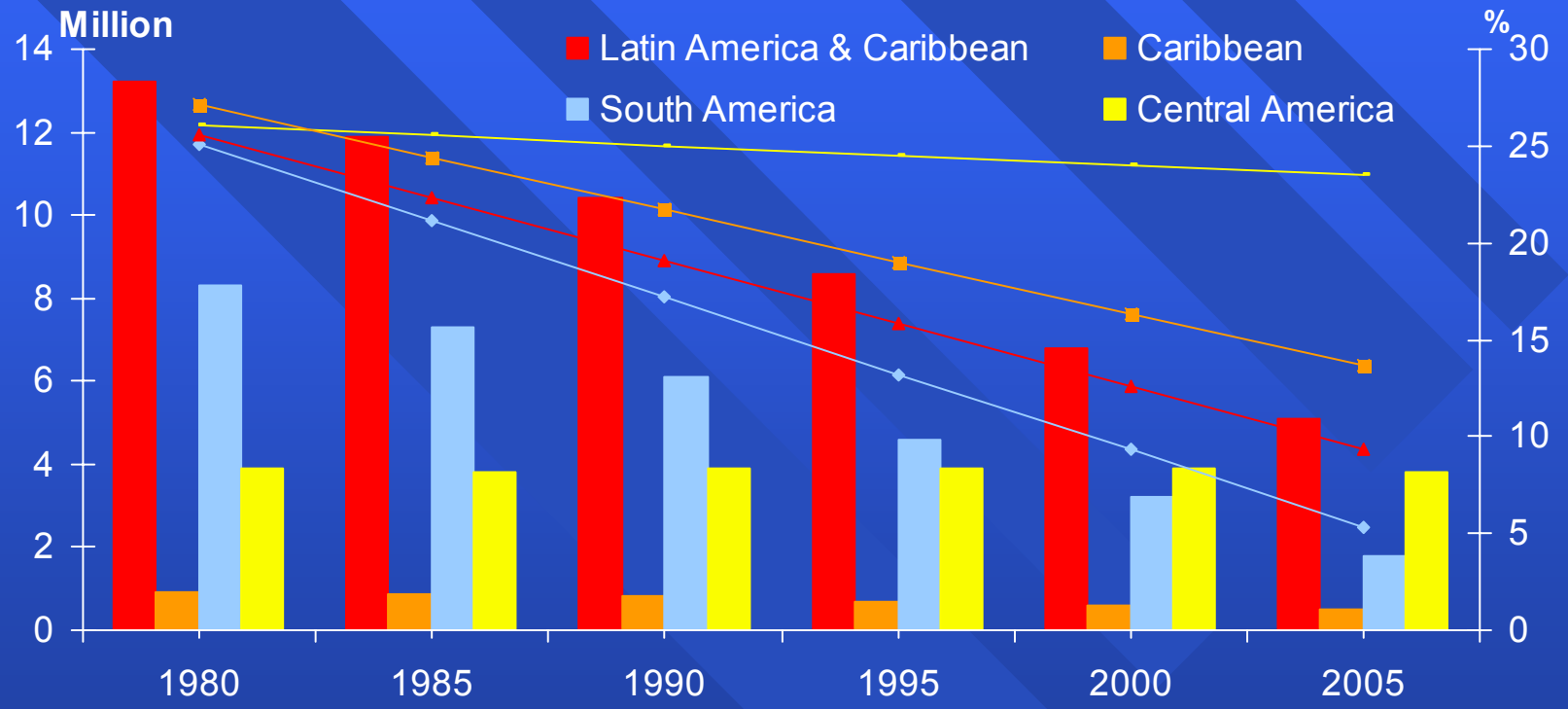
# Trends in estimated numbers of stunted children <5 years




Source: de Onis, Frongillo, Blössner. WHO Bull 2000;78:1222-33.

WHO Global Database on Child Growth and Malnutrition

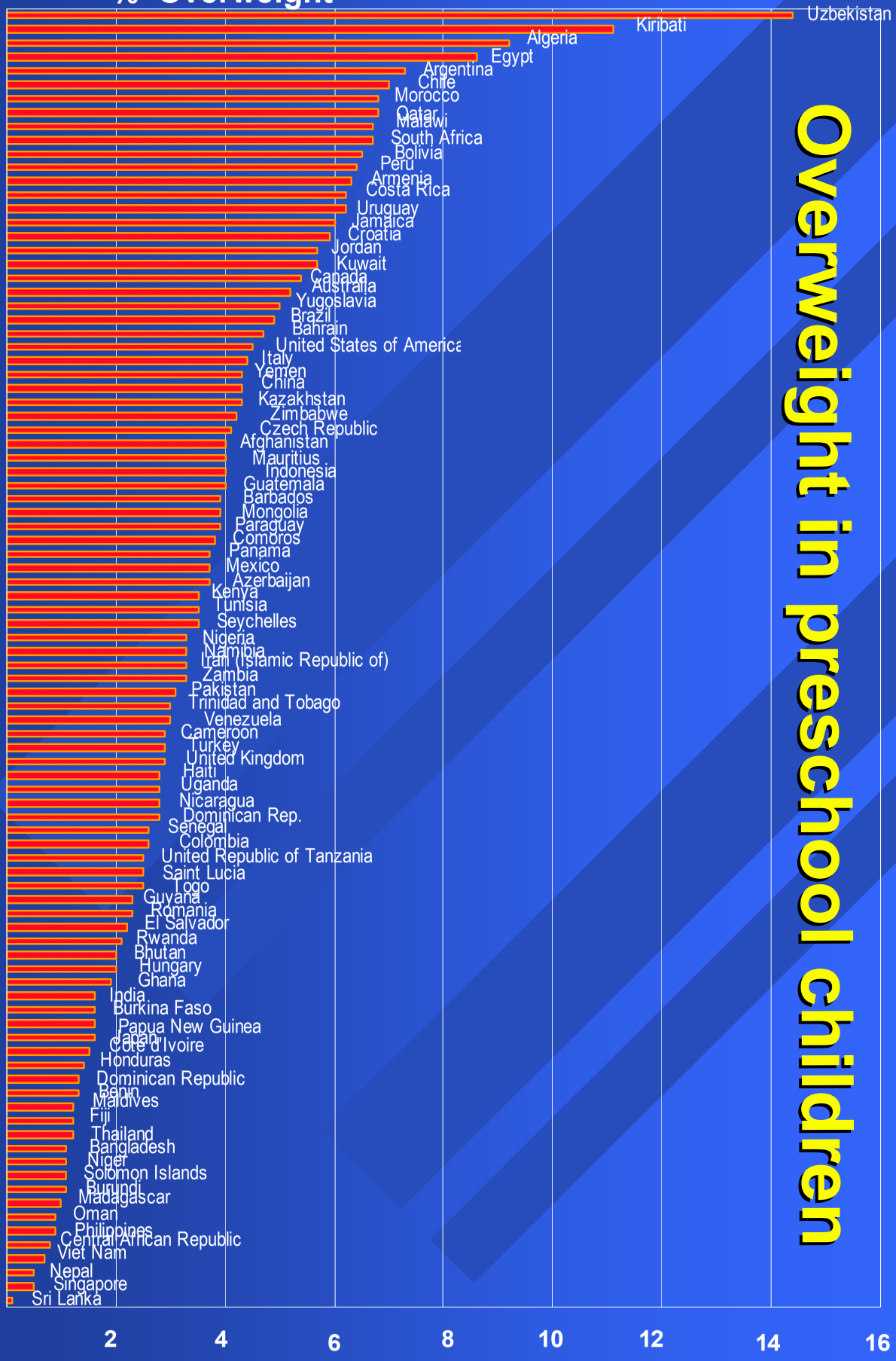
# Trends of stunting in preschool children of Latin America & the Caribbean



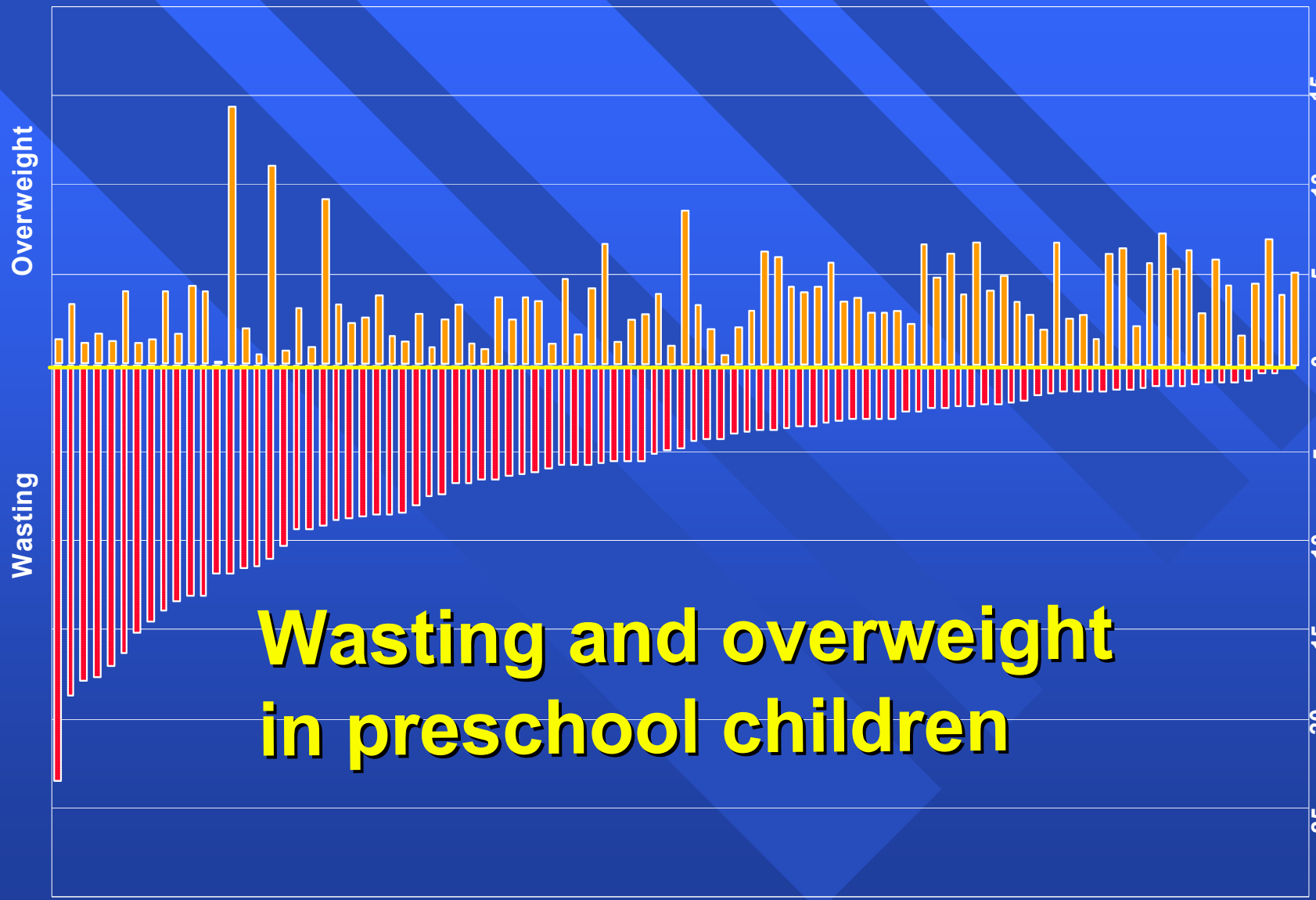

Source: de Onis, Frongillo, Blössner. WHO Bull 2000;78:1222-33.

WHO Global Database on Child Growth and Malnutrition

# Overweight in preschool children




Source: de Onis and Blössner. Am J Clin Nutr 2000;72:1032-9.




# Wasting and overweight in preschool children

Source: de Onis and Blössner. Am J Clin Nutr 2000;72:1032-9.

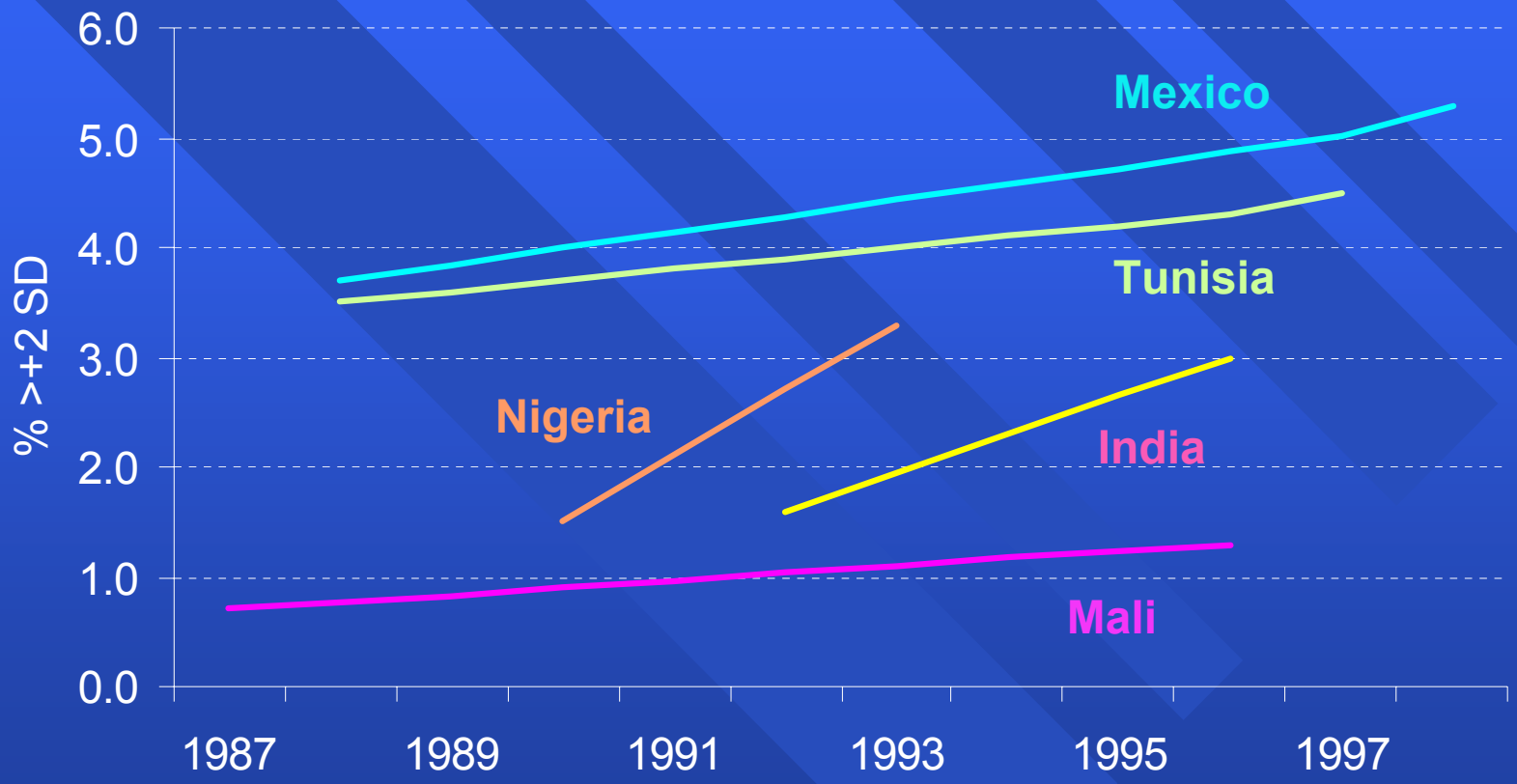
# Overweight estimates in preschool children

| Region | Overweight children (%) | (millions) |
|---|---|---|
| Africa | 3.9 | 4.5 |
| Asia | 2.9 | 10.6 |
| Latin America & Caribbean | 4.4 | 2.4 |
| All developing countries | 3.3 | 17.6 |

Source: de Onis and Blössner. Am J Clin Nutr 2000;72:1032-9.

WHO Global Database on Child Growth and Malnutrition

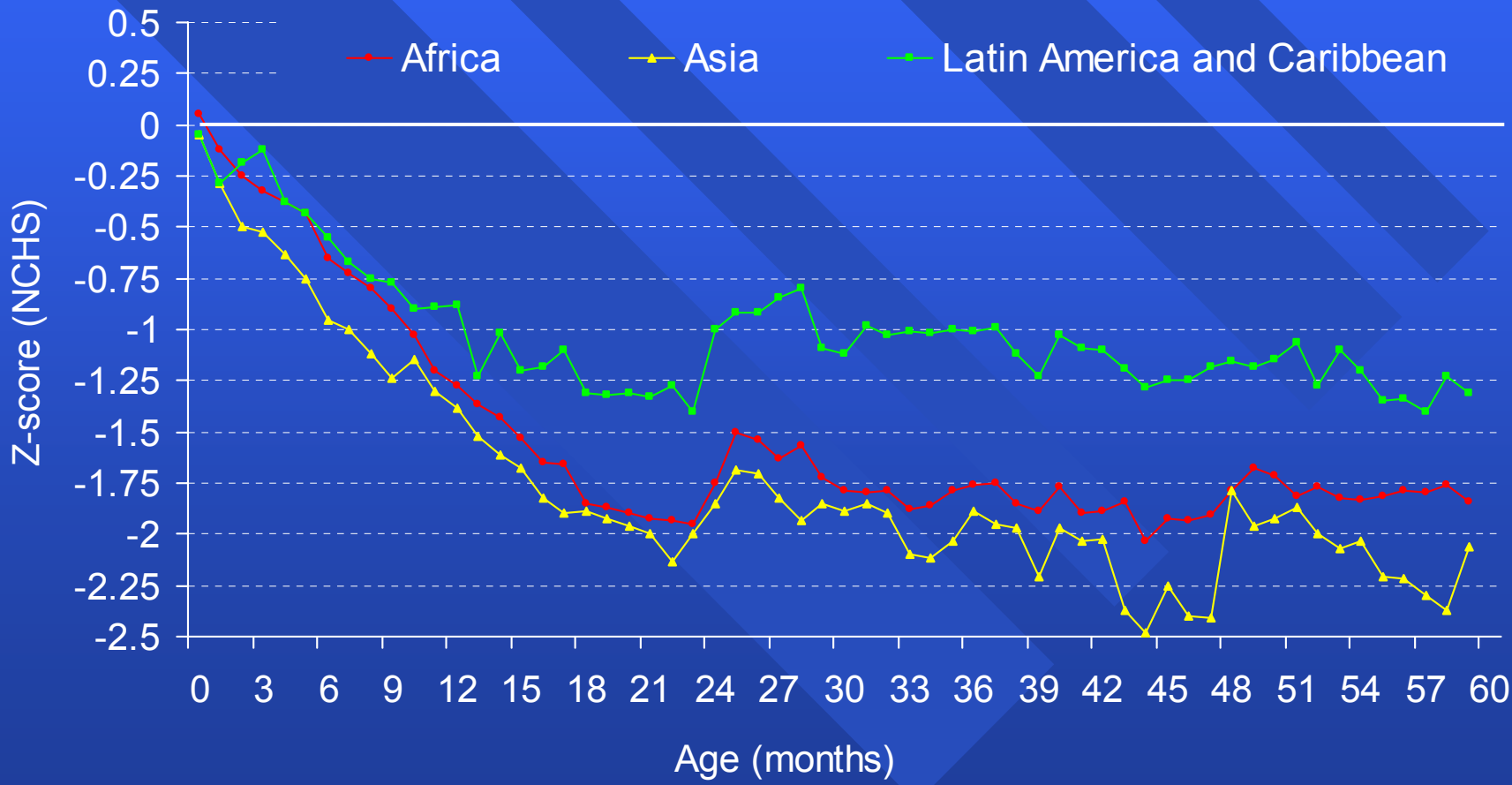
# Trends of overweight in children




Source: de Onis and Blössner. Am J Clin Nutr 2000;72:1032-9.

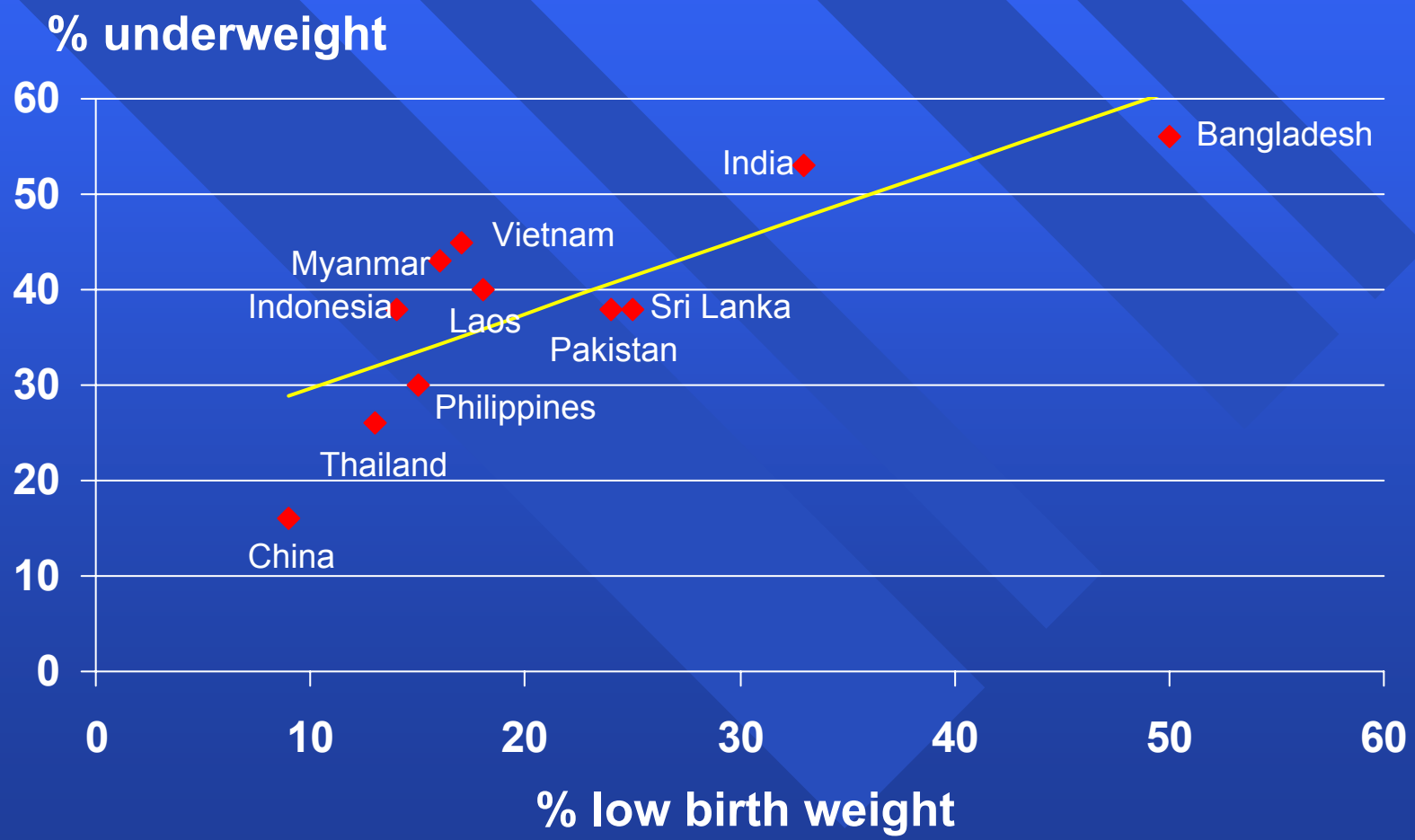
WHO Global Database on Child Growth and Malnutrition

# Timing of growth faltering
## Height-for-age by region




Source: Shrimpton et al. Pediatrics 2001;107(5).

# Relationship between child malnutrition & LBW in selected Asian countries



WORLD HEALTH ORGANIZATION

# *The* WORLD HEALTH REPORT *2002*

## *Reducing Risks, Promoting Healthy Life*

# Underweight prevalence by WHO Mortality Region

| Region | Prevalence of Underweight (% below –2 SD) |
|---|---|
| Afr D | 32.2 |
| Afr E | 31.0 |
| Amr A | 2.3 |
| Amr B | 5.0 |
| Amr D | 12.4 |
| Emr B | 8.1 |
| Emr D | 25.1 |
| Eur A | 2.3 |
| Eur B | 7.6 |
| Eur C | 2.6 |
| Sear B | 25.8 |
| Sear D | 45.9 |
| Wpr A | 3.8 |
| Wpr B | 16.0 |

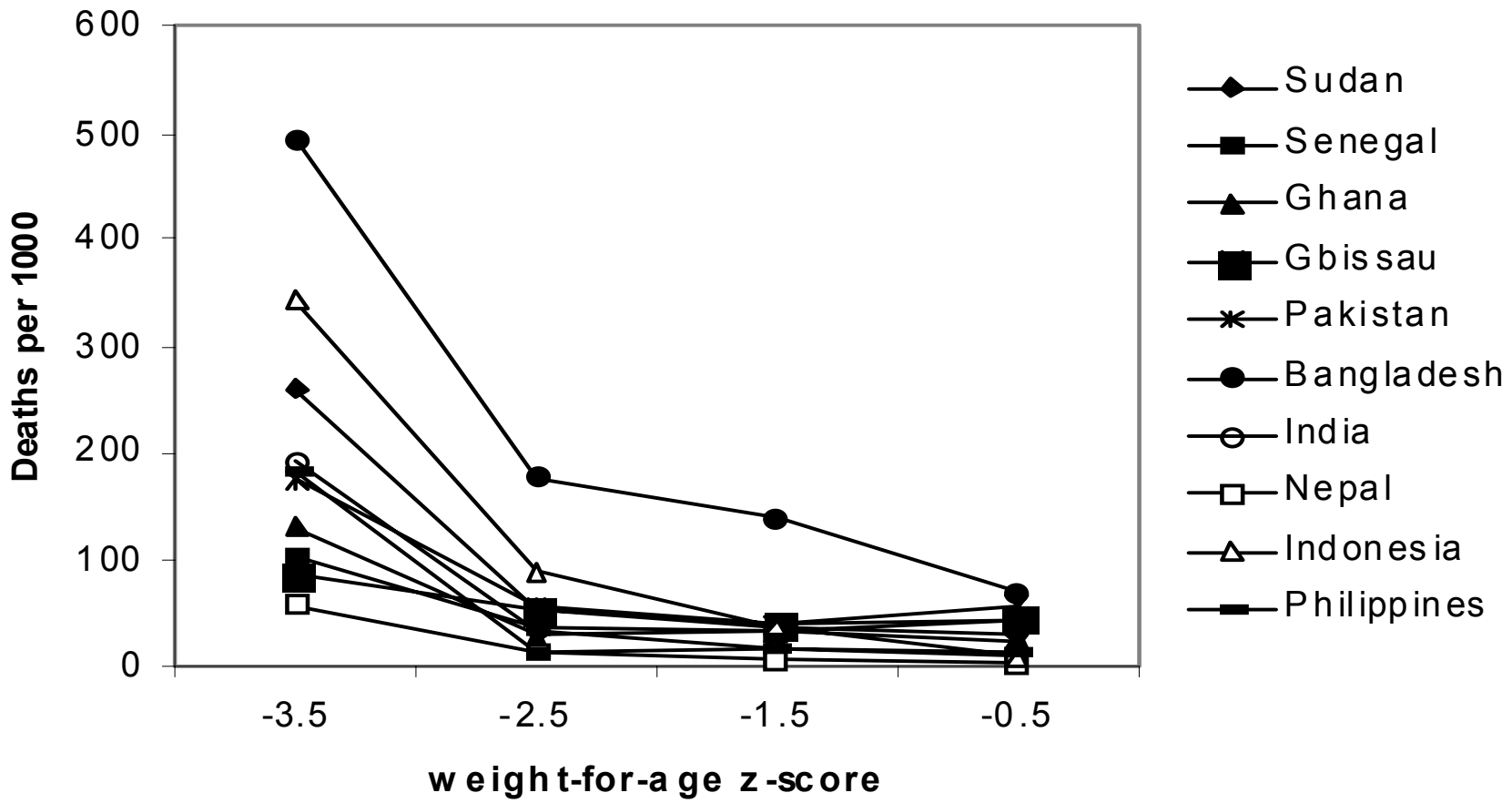
Source: Fishman S, Caulfield LE, de Onis M, et al. In: Comparative Quantification of Health Risks: The Global and Regional Burden of Disease due to 25 Selected Major Risk Factors. WHO/Harvard University Press, Cambridge, 2003 (in press).

# Mean Z-scores and prevalence by WA category according to WHO mortality Region

| Region | Mean Z-score | Percent of Children in WA Category (%) | | | |
|---|---|---|---|---|---|
| | | < -3 SD | > -3,< -2 SD | > -2,< -1 SD | > -1 SD,< 0 |
| Afr D | -1.54 | 7.2 | 25.1 | 38.3 | 29.4 |
| Afr E | -1.5 | 6.8 | 24.2 | 38.3 | 24.2 |
| Amr A | 0 | 0.1 | 2.1 | 13.6 | 34.1 |
| Amr B | -0.35 | 0.5 | 4.5 | 20.8 | 37.9 |
| Amr D | -0.84 | 1.6 | 10.8 | 31.3 | 36.3 |
| Emr B | -0.6 | 0.8 | 7.3 | 26.3 | 38.1 |
| Emr D | -1.33 | 4.7 | 20.4 | 37.8 | 27.9 |
| Eur A | 0 | 0.1 | 2.1 | 13.6 | 34.1 |
| Eur B | -0.57 | 0.7 | 6.9 | 25.7 | 38.2 |
| Eur C | -0.05 | 0.2 | 2.4 | 14.5 | 34.9 |
| Sear B | -1.35 | 5.0 | 20.8 | 37.9 | 27.5 |
| Sear D | -1.9 | 13.4 | 32.5 | 35.8 | 15.5 |
| Wpr A | -0.22 | 0.3 | 3.5 | 18.0 | 36.9 |
| Wpr B | -1 | 2.3 | 13.6 | 34.1 | 34.1 |

Source: Fishman S, Caulfield LE, de Onis M, et al. In: Comparative Quantification of Health Risks: The Global and Regional Burden of Disease due to 25 Selected Major Risk Factors. WHO/Harvard University Press, Cambridge, 2003 (in press).

# Underweight and all-cause mortality: (a) deaths per 1000




Source: Fishman S, Caulfield LE, de Onis M, et al. In: Comparative Quantification of Health Risks: The Global and Regional Burden of Disease due to 25 Selected Major Risk Factors. WHO/Harvard University Press, Cambridge, 2003 (in press).

# RR of mortality overall and by cause associated with low weight-for-age

| Cause of Death | < -3 SD | < -2 to -3 SD | -1 to –2 SD | >-1 SD |
|---|---|---|---|---|
| Diarrhea | 12.50 | 5.39 | 2.32 | 1.0 |
| Pneumonia | 8.09 | 4.03 | 2.01 | 1.0 |
| Malaria | 9.49 | 4.48 | 2.12 | 1.0 |
| Measles | 5.22 | 3.01 | 1.73 | 1.0 |
| All-cause | 8.72 | 4.24 | 2.06 | 1.0 |

Source: Fishman S, Caulfield LE, de Onis M, et al. In: Comparative Quantification of Health Risks: The Global and Regional Burden of Disease due to 25 Selected Major Risk Factors. WHO/Harvard University Press, Cambridge, 2003 (in press).

# Total Burden of underweight status among children 0-4 year

| Disease | Mortality (WA < -1 SD) | | |
|---|---|---|---|
| | Attributable Fraction (%) | Attributable Mortality (x 1000) | Attributable Burden (DALYs, x 1000) |
| Protein-Energy Malnutrition | 100.0 | 153.6 | 14,885.2 |
| Perinatal Conditions* | 9.0 | 127.4 | 4,610.7 |
| Pneumonia/ALRI | 52.3 | 1,042.9 | 35,135.0 |
| Diarrhea | 60.7 | 815.9 | 27,500.1 |
| Malaria | 57.3 | 549.2 | 18,572.7 |
| Measles | 44.8 | 261.3 | 9,102.1 |
| Other | 53.1 | 776.9 | 26,355.8 |
| TOTAL** | 48.5 | 3,727.2 | 136,161.6 |

* "Perinatal conditions" estimates reflect deaths due to low birth weight only.

** 57.3% of all early childhood deaths beyond the perinatal period

Source: Fishman S, Caulfield LE, de Onis M, et al. In: Comparative Quantification of Health Risks: The Global and Regional Burden of Disease due to 25 Selected Major Risk Factors. WHO/Harvard University Press, Cambridge, 2003 (in press).

# Comparative Risk Assessment

| Rank | Risk Factor | DALYs (000) | % total global DALYs |
|---|---|---|---|
| 1 | Underweight | 204,945 | 13.9% |
| 2 | Unsafe sex | 93,728 | 6.4% |
| 3 | Blood pressure | 60,203 | 4.1% |
| 4 | Tobacco | 57,234 | 3.9% |
| 5 | Alcohol | 56,382 | 3.8% |
| 6 | Unsafe water, sanitation, and hygiene | 54,645 | 3.7% |
| 7 | Non-breastfeeding | 49,882 | 3.4% |
| 8 | Iron deficiency | 49,705 | 3.4% |
| 9 | Indoor smoke from solid fuels | 36,873 | 2.5% |
| 10 | Cholesterol | 34,660 | 2.4% |
| 11 | Inadequate fruit and vegetable intake | 27,591 | 1.9% |
| 12 | Body mass | 27,376 | 1.9% |
| 13 | Zinc deficiency | 23,874 | 1.6% |

Source: World Health Report 2002

# Comparative Risk Assessment

| Rank | Risk Factor | DALYs (000) | % total global DALYs |
|---|---|---|---|
| 14 | Physical inactivity | 21,349 | 1.5% |
| 15 | Physical hazards causing injury | 13,455 | 0.9% |
| 16 | Illicit drugs | 10,137 | 0.7% |
| 17 | Vitamin A deficiency | 9,223 | 0.6% |
| 18 | Childhood sexual abuse | 7,914 | 0.5% |
| 19 | Ambient air pollution | 7,387 | 0.5% |
| 20 | Unplanned pregnancies | 5,459 | 0.4% |
| 21 | Lead | 3,494 | 0.2% |
| 22 | Unsafe health care injections | 3,028 | 0.2% |
| 23 | Climate change | 3,012 | 0.2% |
| 24 | Chemical or physical agents causing cancer | 1,210 | 0.08% |
| 25 | Chemical agents causing non-malignant respiratory disease | 466 | 0.03% |
| 26 | Noise levels | 324 | 0.02% |

Source: World Health Report 2002

# Dissemination via internet

**Bimonthly updates accessible at:**

**www.who.int/nutgrowthdb**

**+ 6500 registrations (May 1999 - May 2002)**