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

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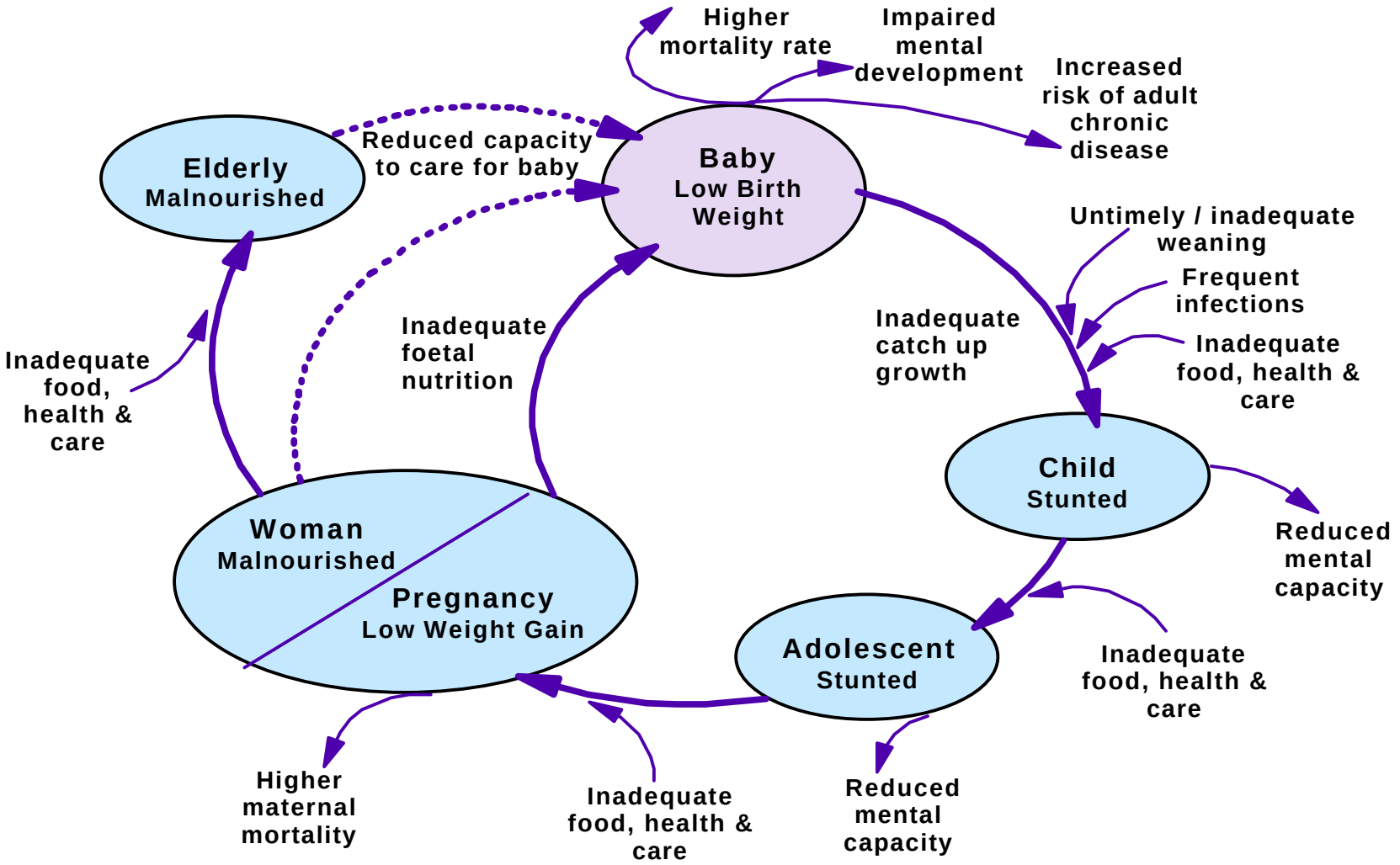
King Size
12x1kg
Nestlé
CHOCOLIM

Assessing nutritional status of lactating mothers

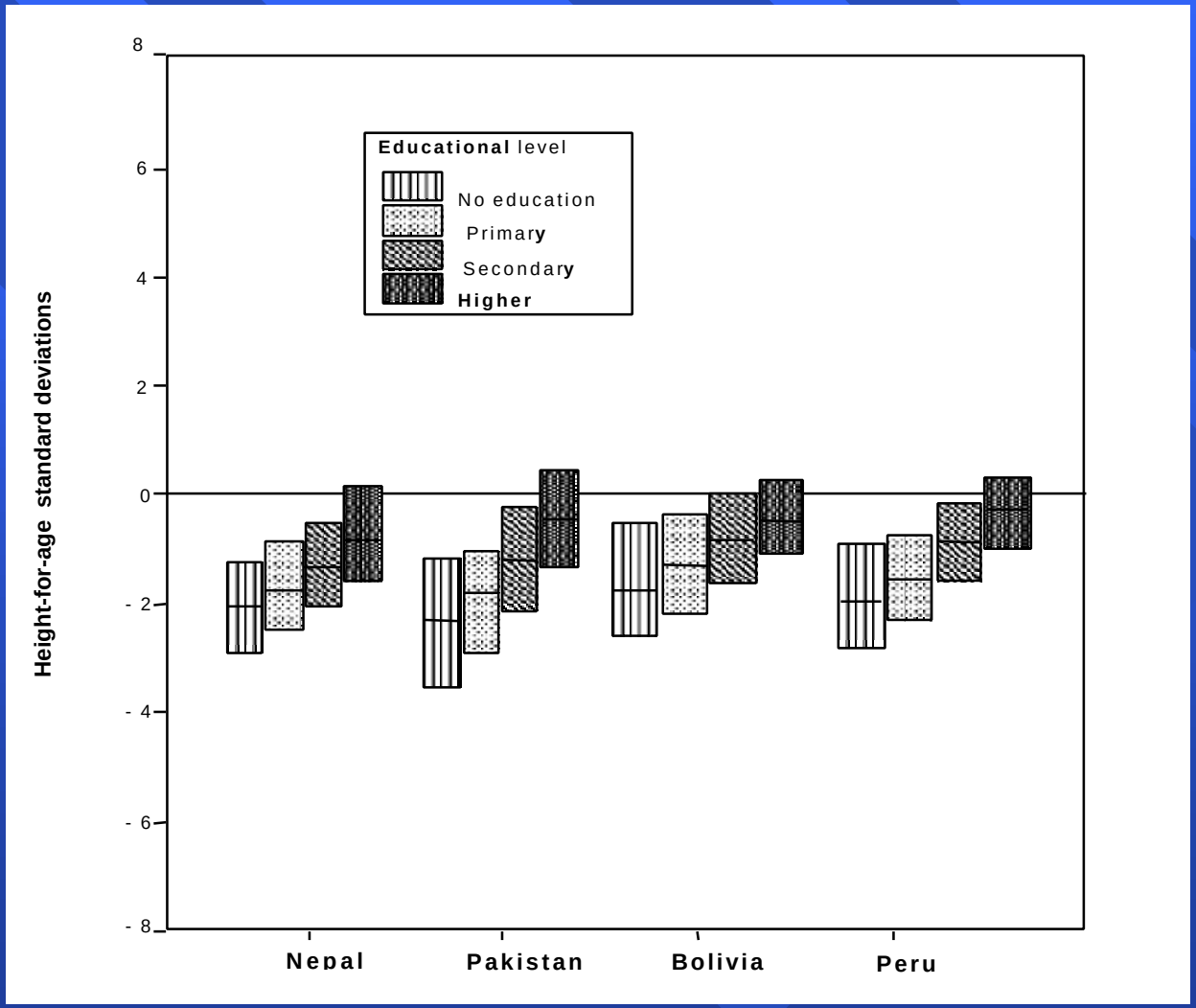
WHO Multicentre Growth Reference Study

Nutrition through the life cycle



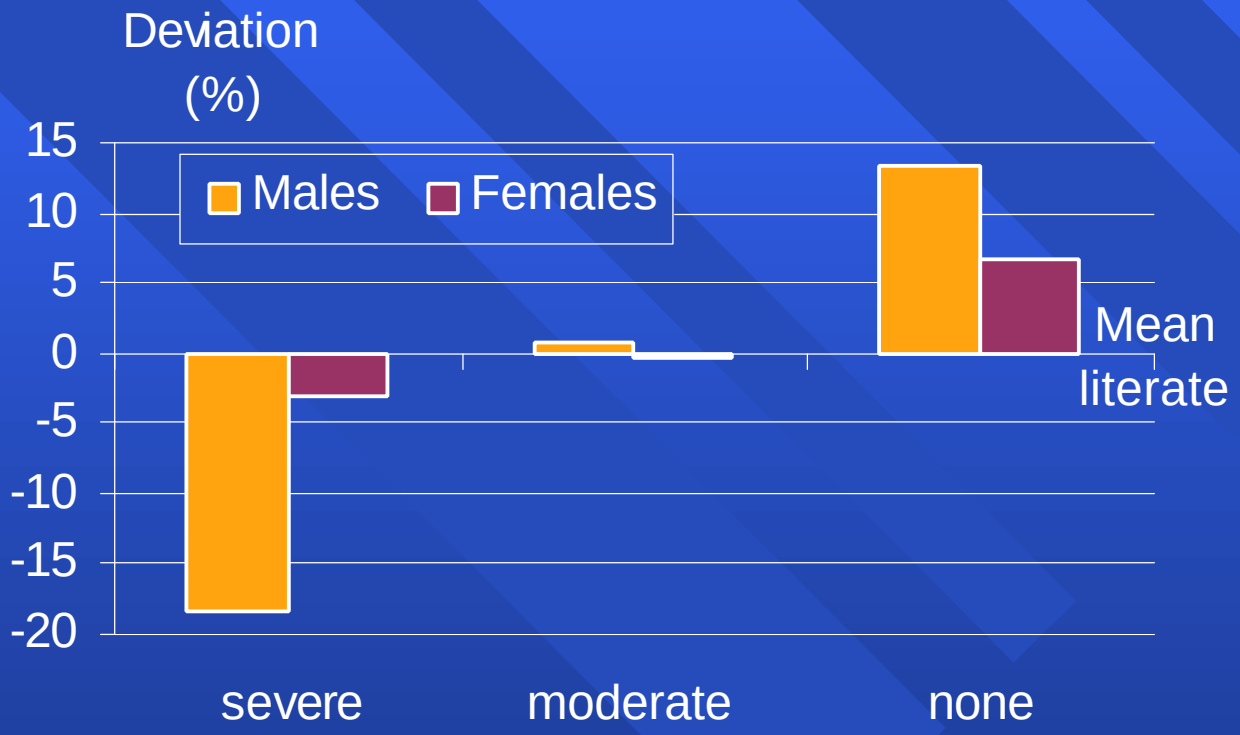
Source: 4th Report on the World Nutrition Situation. ACC/SCN, 2000.

Variation of height-for-age according to maternal education



Source: de Onis M. Socioeconomic status and child growth. Int J Epidemiol 2003;32:503-5.

- **Deviation from sex-specific mean literacy rate associated to levels of malnutrition**



Source: Adapted from Martorell et al., 1992

Methods in anthropometry

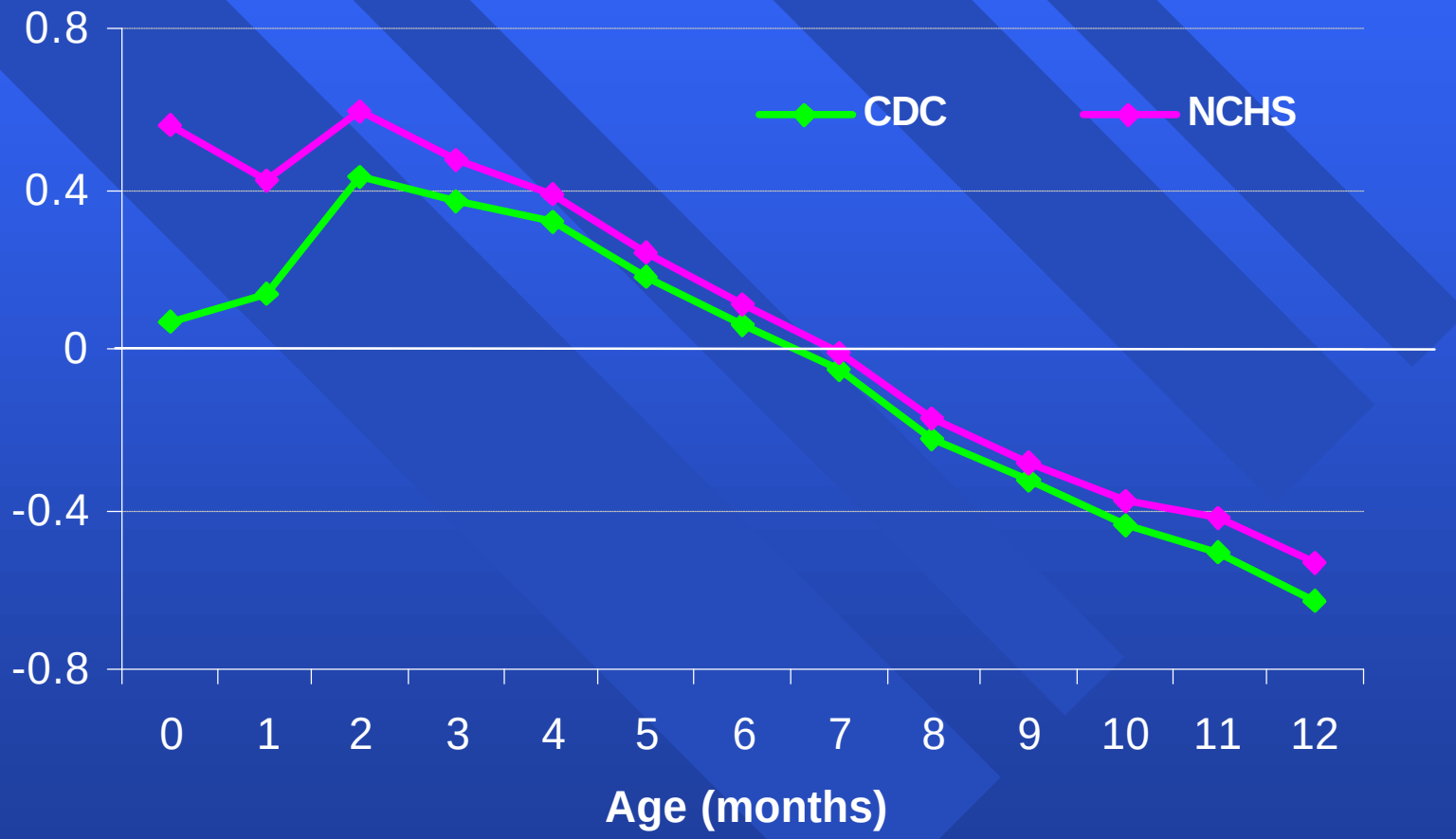
- Anthropometric indicators
- Reference population
- Cut-off points
- Applications of anthropometry

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 ✓**

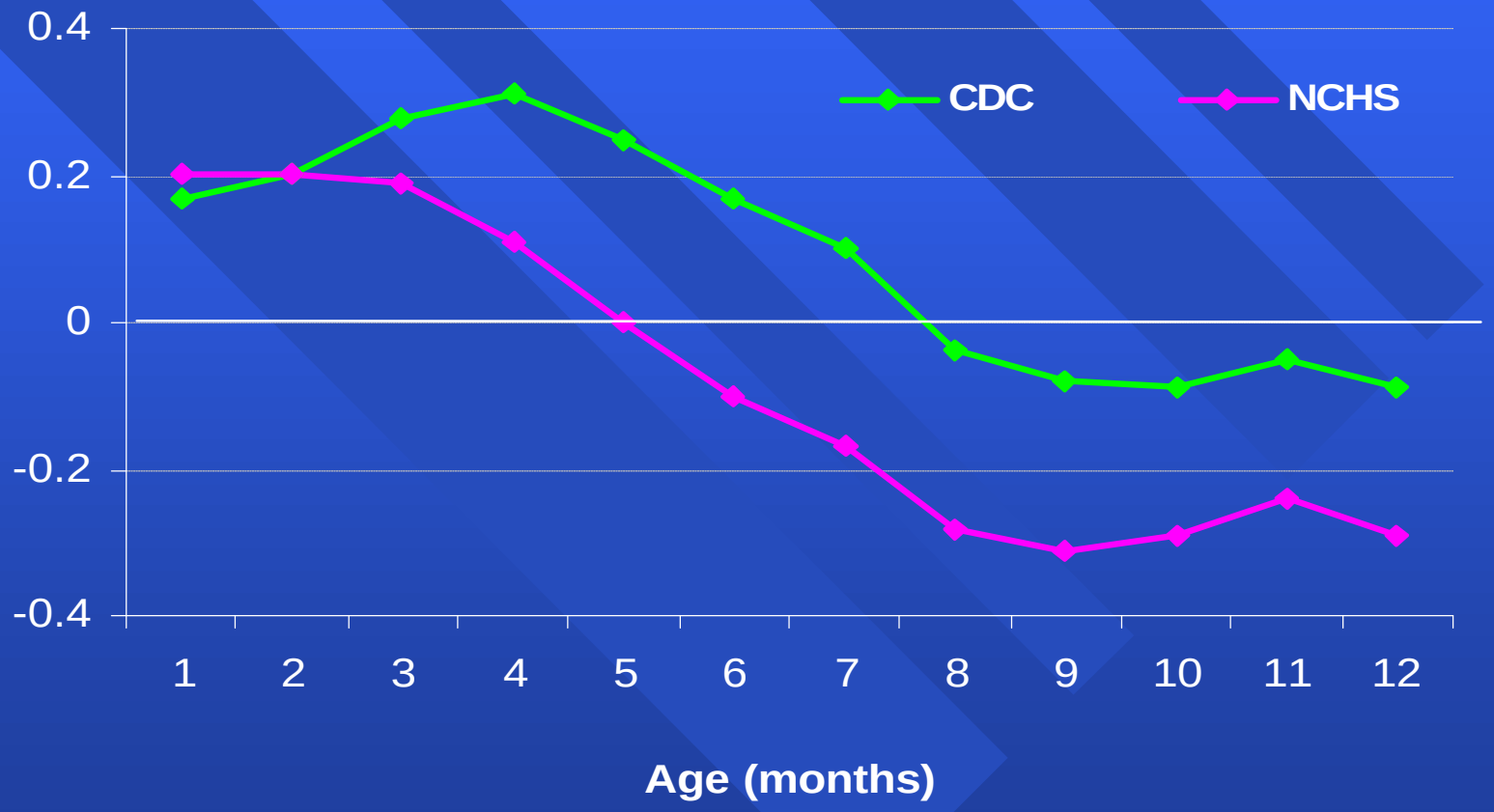
WHO Multicentre Growth Reference Study

Mean weight-for-age z-score



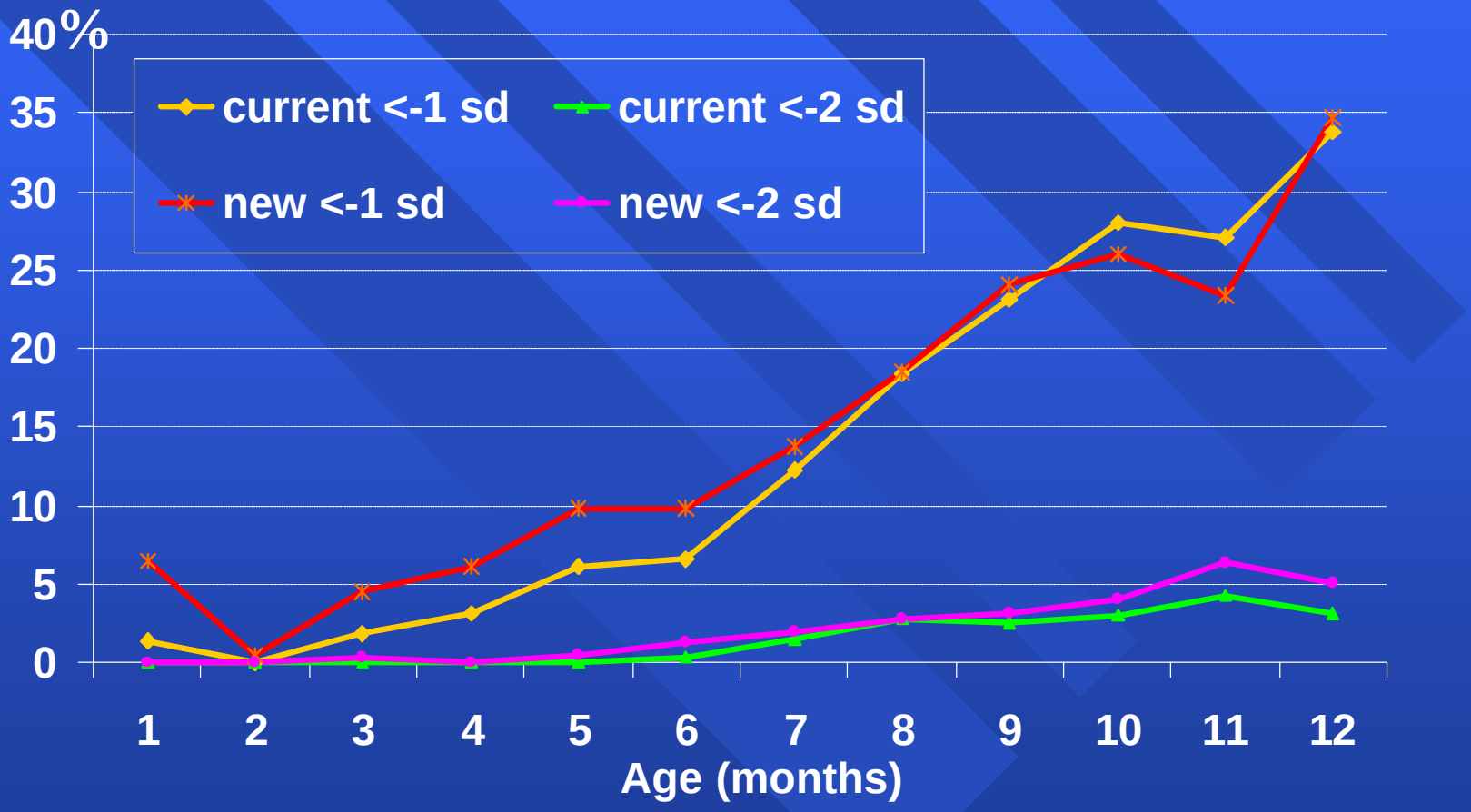
Source: de Onis M, Onyango A. The CDC reference and the growth of breast-fed infants. Acta Paediatrica 2003;92:413-9.

Mean length-for-age z-score



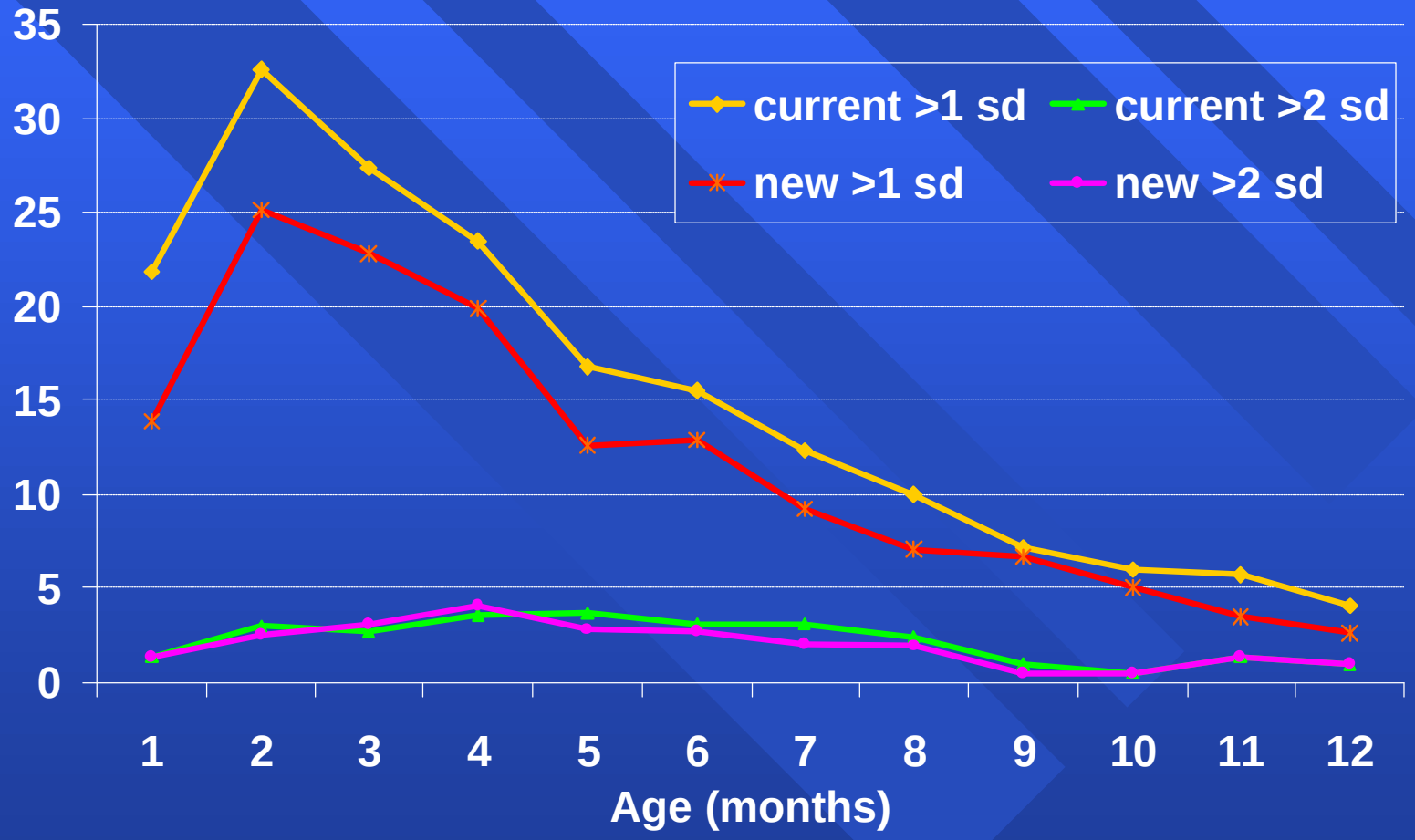
Source: de Onis M, Onyango A. The CDC reference and the growth of breast-fed infants. Acta Paediatrica 2003;92:413-9.

Weight-for-age % < -1 and <-2 SD



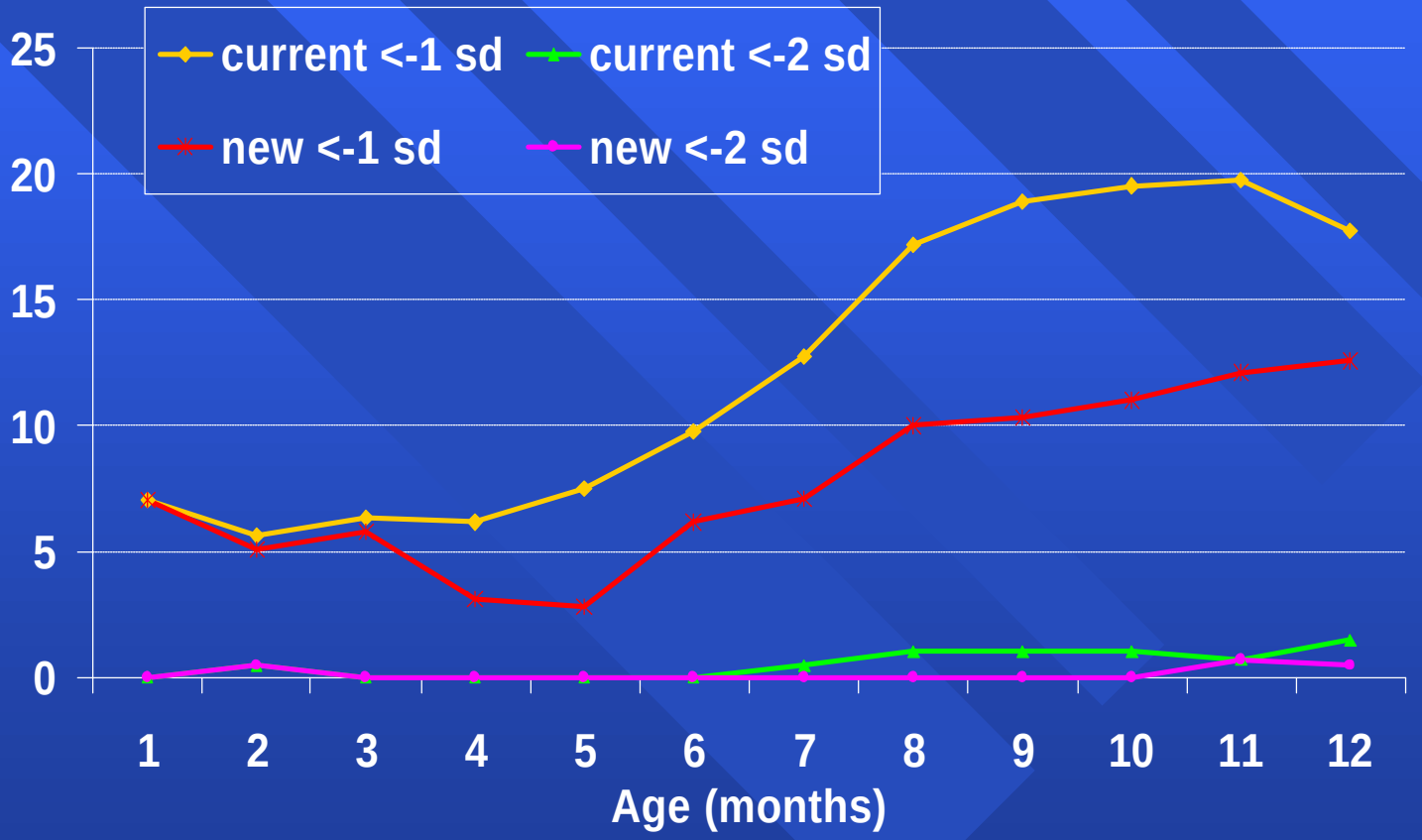
Source: de Onis M, Onyango A. The CDC reference and the growth of breast-fed infants. Acta Paediatrica 2003;92:413-9.

Weight-for-age %>+1 and >+2 SD



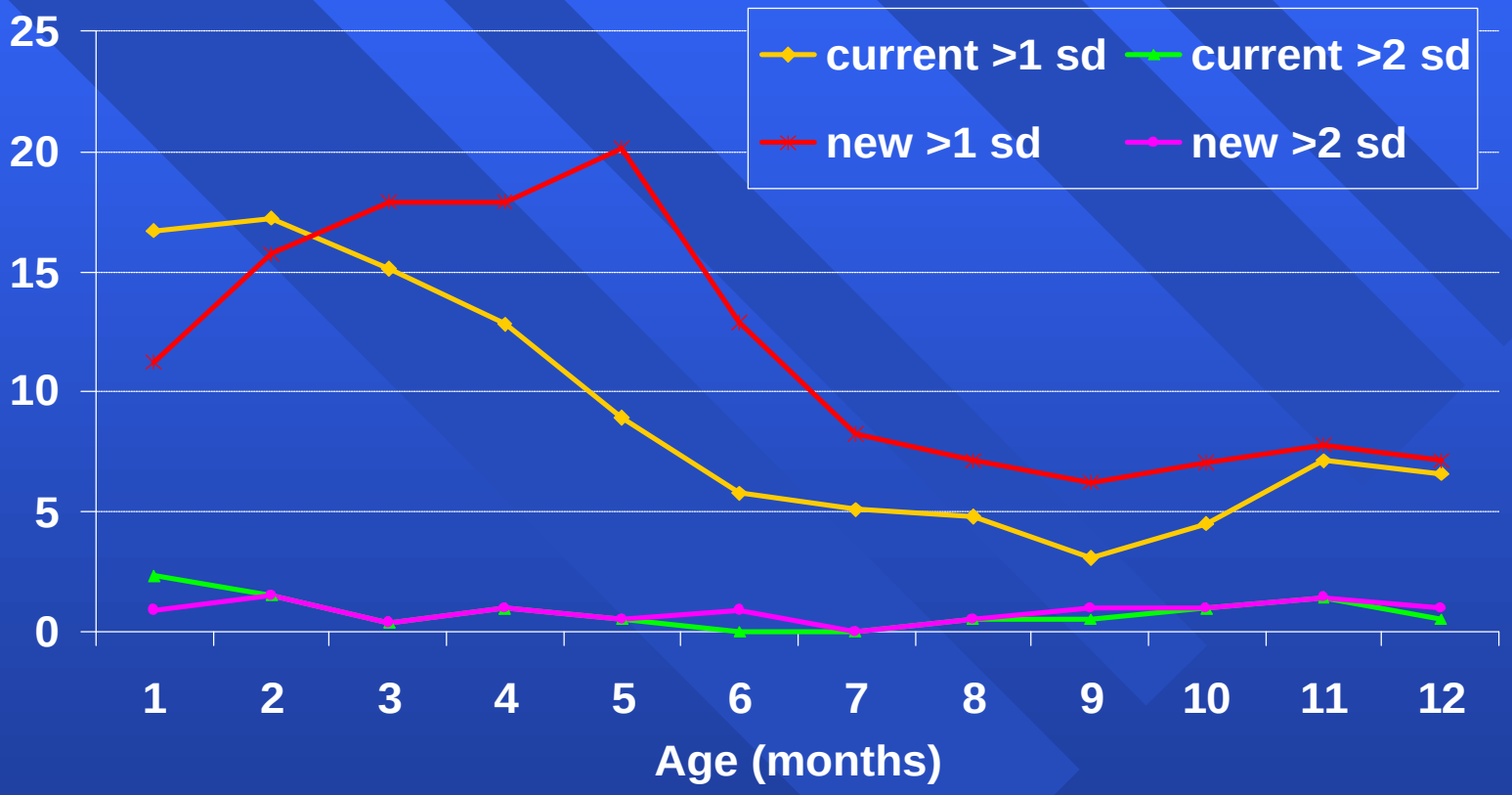
Source: de Onis M, Onyango A. The CDC reference and the growth of breast-fed infants. Acta Paediatrica 2003;92:413-9.

Length-for-age % <-1 and <-2 SD



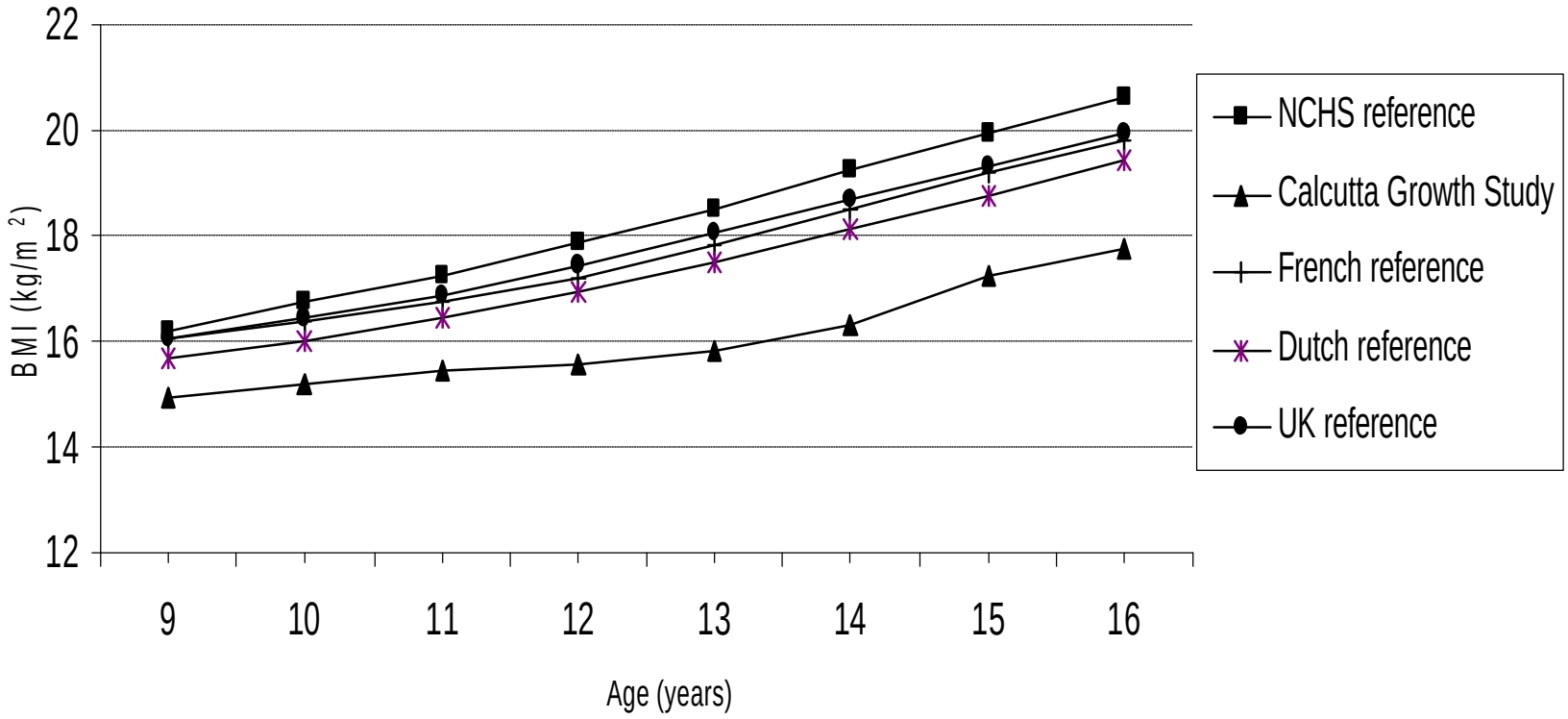
Source: de Onis M, Onyango A. The CDC reference and the growth of breast-fed infants. Acta Paediatrica 2003;92:413-9.

Length-for-age % >+1 and >+2 SD



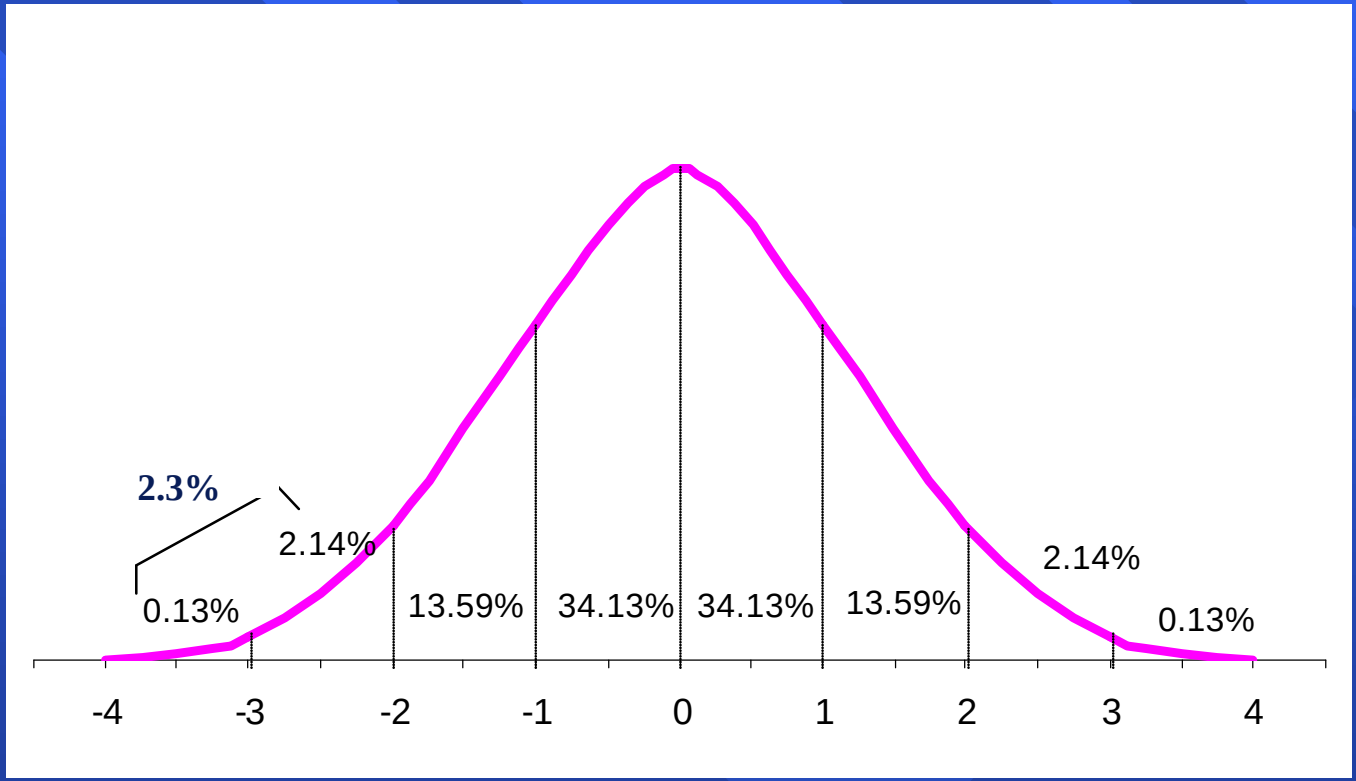
Source: de Onis M, Onyango A. The CDC reference and the growth of breast-fed infants. Acta Paediatrica 2003;92:413-9.

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. Am J Clin Nutr 2001; 74:248-253

Standard normal distribution of child growth and prevalence under the curve between SD ranges



WHO Global Database on Child Growth and Malnutrition

Department of Nutrition

www.who.int/nutgrowthdb

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

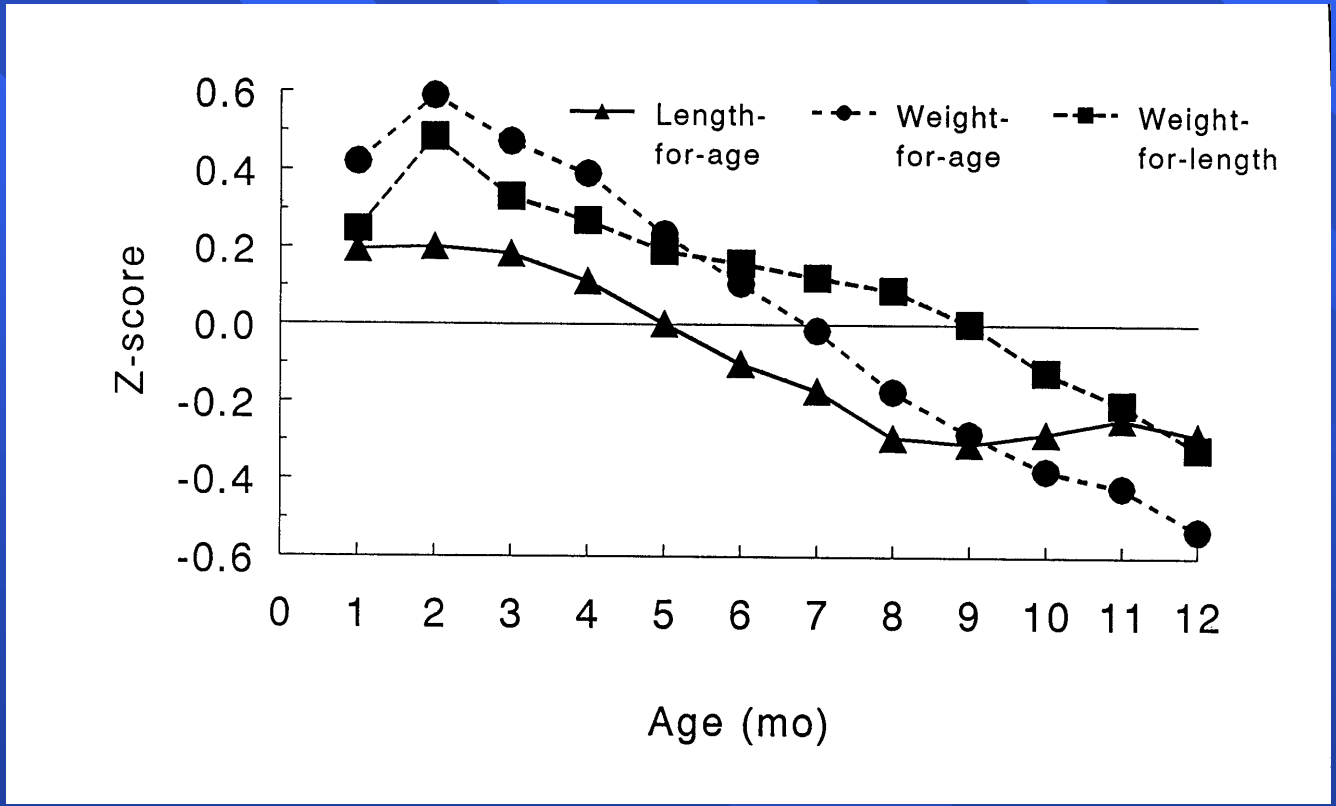
Methods: Data standardization

- 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

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)

Mean Z-scores of infants in the "12-month breastfed pooled data set" relative to the NCHS/WHO reference



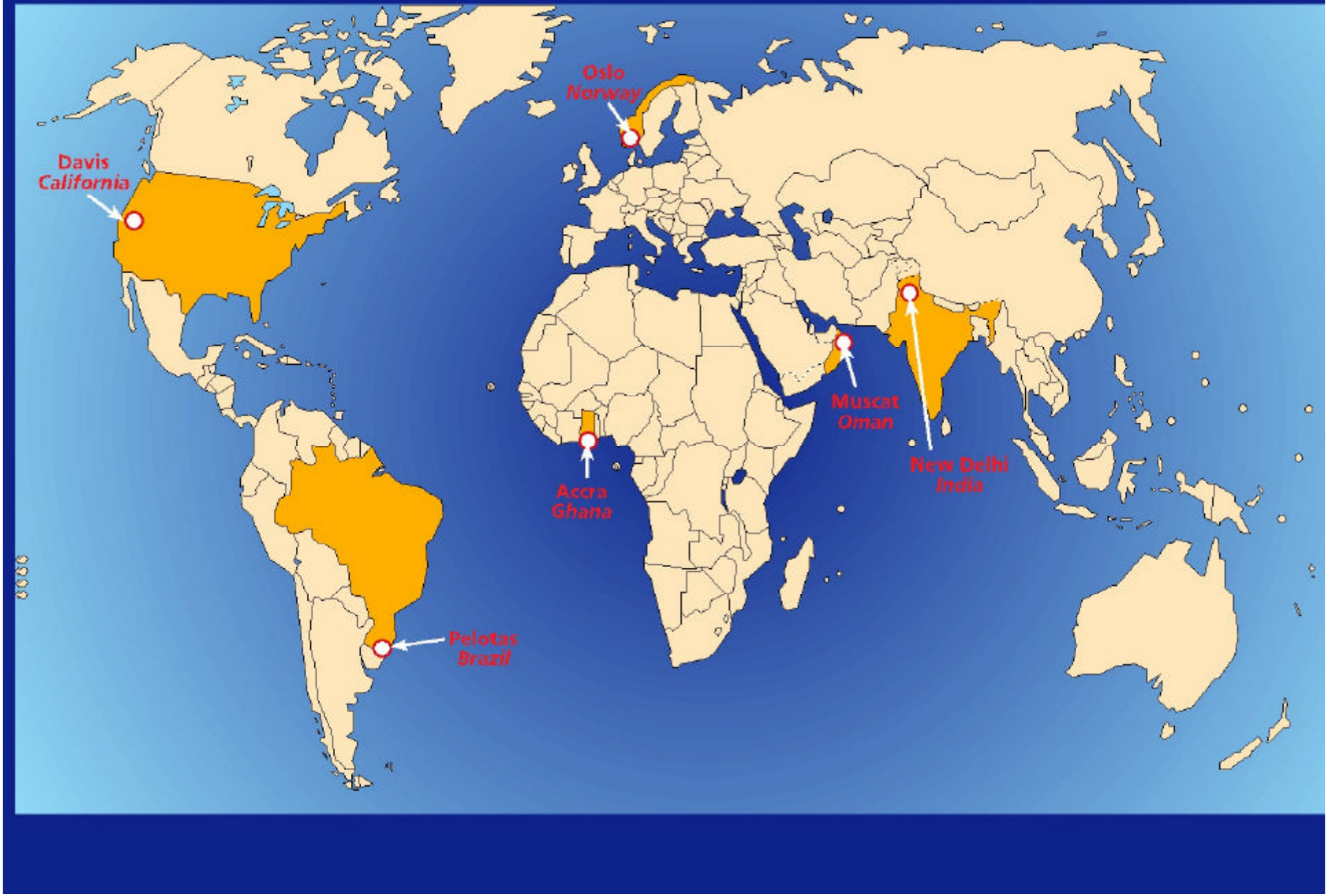
Source: An Evaluation of Infant Growth. WHO, 1994

A Growth Curve for the 21st Century

The WHO Multicentre Growth Reference Study

Department of Nutrition

WHO MULTICENTRE GROWTH REFERENCE STUDY (MGRS)



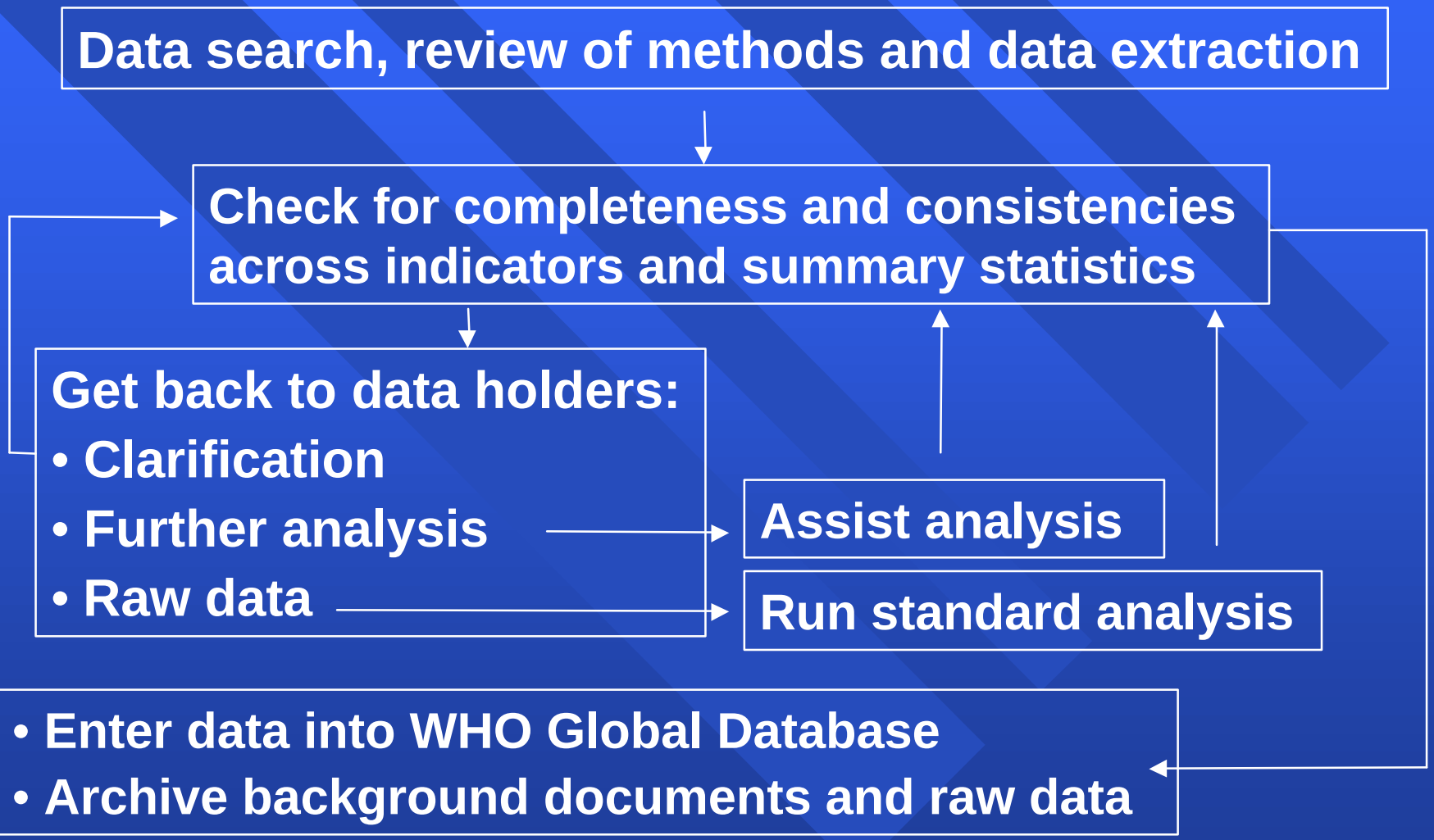
Main features of the new International Growth Reference

- 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.)

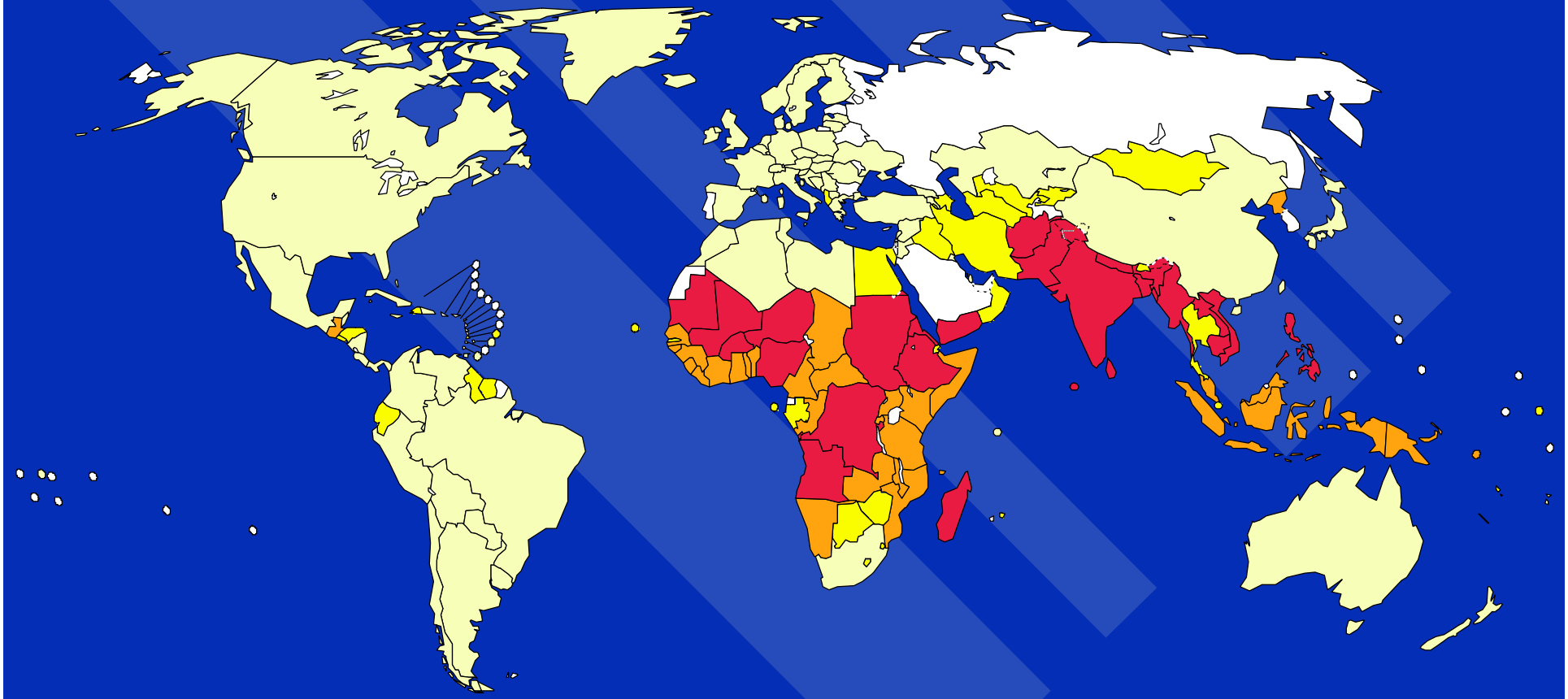
Database work-flow



Coverage (January 2004)

- 454 national surveys from 143 countries
- 486 sub-national surveys 158 countries
- 99% children <5 yr in developing countries
- 67% children <5 yr in developed countries
- 2536 references

Global distribution of child underweight (November 2003)



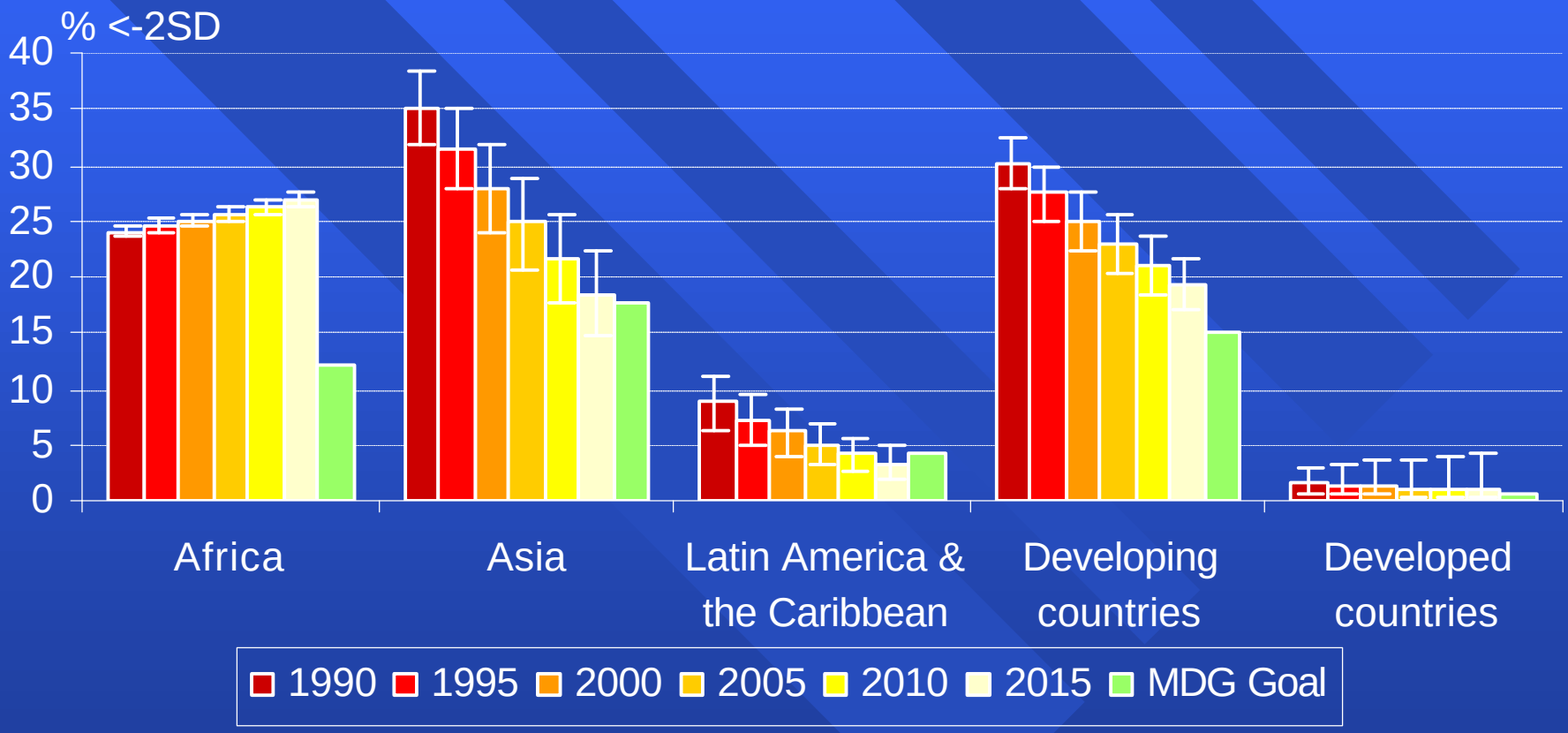
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Global and regional estimates of stunted children in 2000

Region	Stunted children (%)	(millions)
Africa	35	45
Asia	30	109
Latin America & Caribbean	14	8
All developing countries	30	162

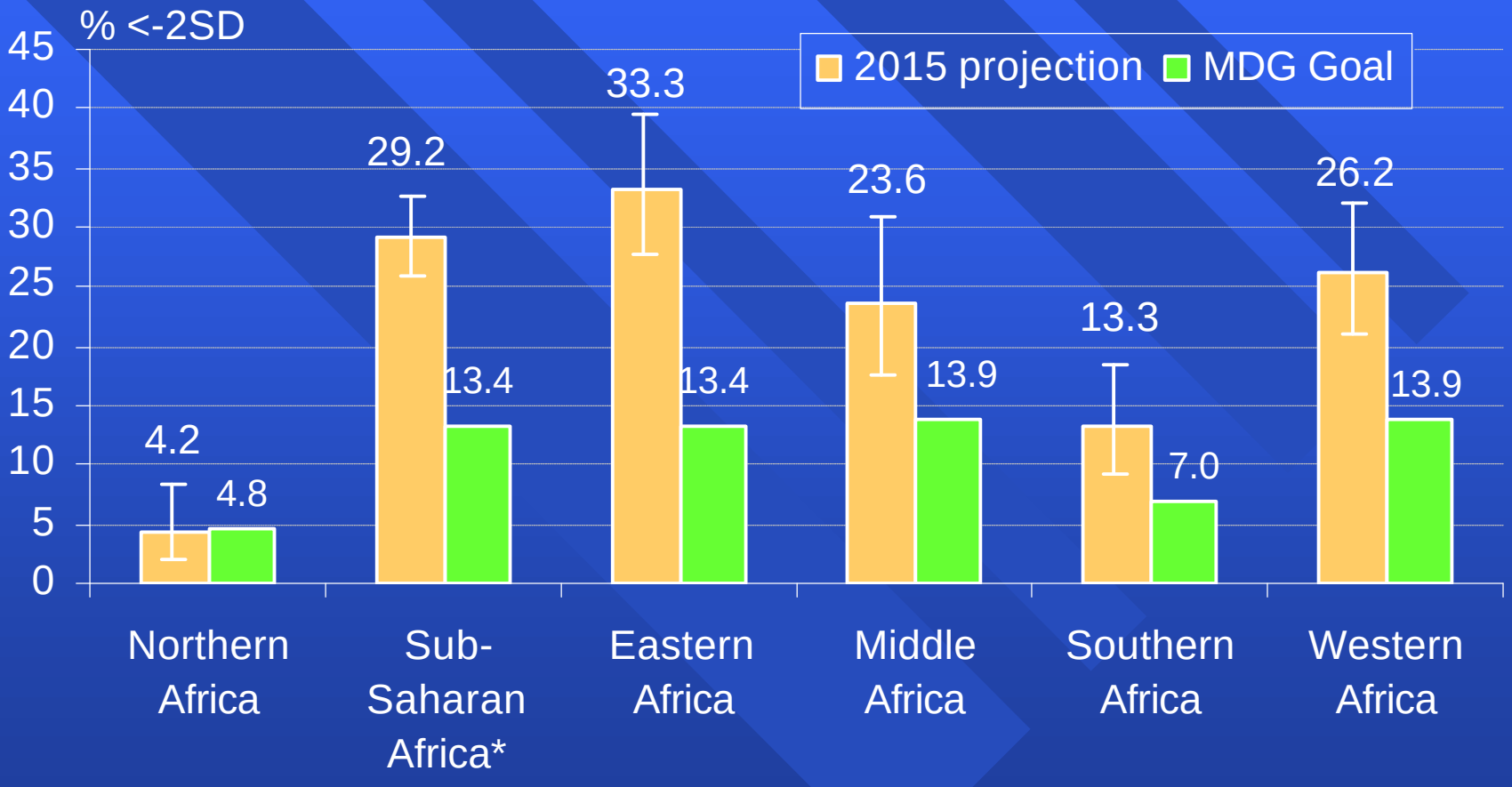
Source: de Onis et al. Int J Epidemiol 2004 (in submission).

Trends of underweight prevalence in children <5 years compared to the MDG Goal in 2015



Source: de Onis M, Blössner M. **The World Health Organization Global Database on Child Growth and Malnutrition: methodology and applications. Int J Epidemiol 2003;32:518-26.**

Subregional projections of underweight prevalence with 95% CI in 2015 compared to MDG Goal



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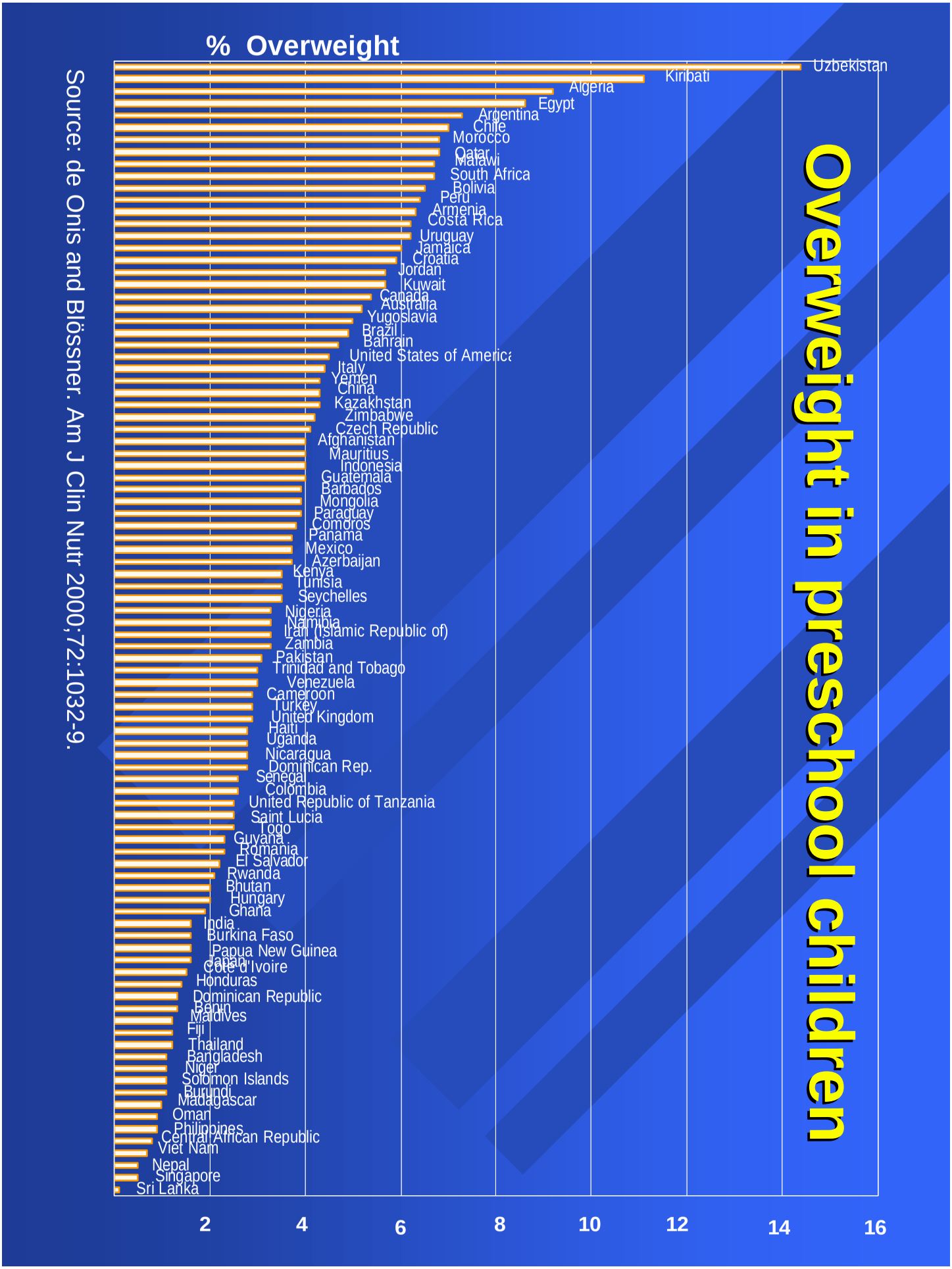
Overweight in preschool children
% Overweight
Source: de Onis and Blössner. Am J Clin Nutr 2000;72:1032-9.
Uzbekistan
Kiribati
Algeria
Egypt
Argentina
Chile
Morocco
Qatar
Malawi
South Africa
Bolivia
Peru
Armenia
Costa Rica
Uruguay
Jamaica
Croatia
Jordan
Kuwait
Canada
Australia
Yugoslavia
Brazil
Bahrain
United States of America
Italy
Yemen
China
Kazakhstan
Zimbabwe
Czech Republic
Afghanistan
Mauritius
Indonesia
Guatemala
Barbados
Mongolia
Paraguay
Comoros
Panama
Mexico
Azerbaijan
Kenya
Tunisia
Seychelles
Nigeria
Namibia
Iran (Islamic Republic of)
Zambia
Pakistan
Trinidad and Tobago
Venezuela
Cameroon
Turkey
United Kingdom
Haiti
Uganda
Nicaragua
Dominican Rep.
Senegal
Colombia
United Republic of Tanzania
Saint Lucia
Togo
Guyana
Romania
El Salvador
Rwanda
Bhutan
Hungary
Ghana
India
Burkina Faso
Papua New Guinea
Japan
Côte d'Ivoire
Honduras
Dominican Republic
Benin
Maldives
Fiji
Thailand
Bangladesh
Niger
Solomon Islands
Burundi
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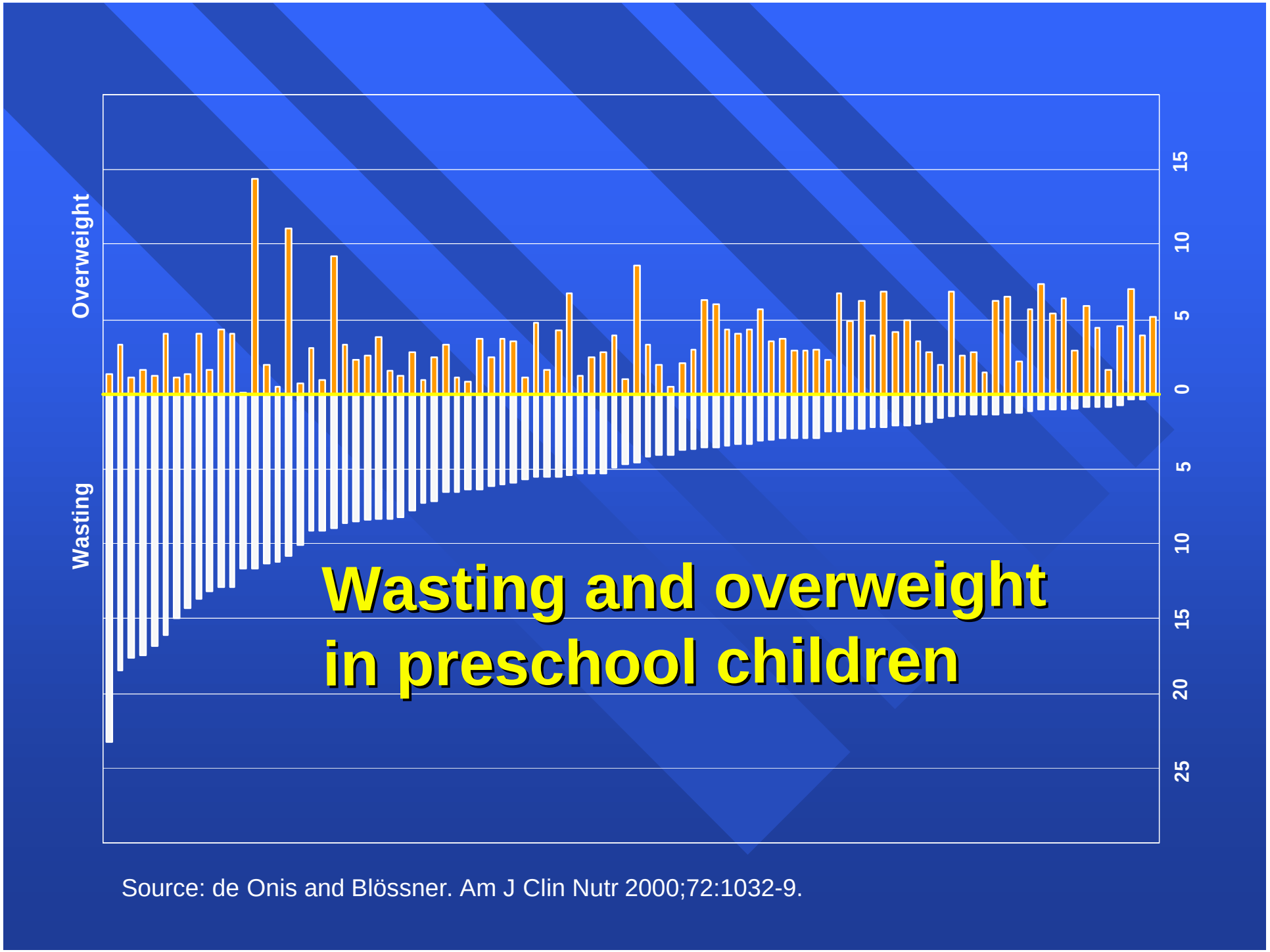


Source: de Onis and Blössner. Am J Clin Nutr 2000;72:1032-9.

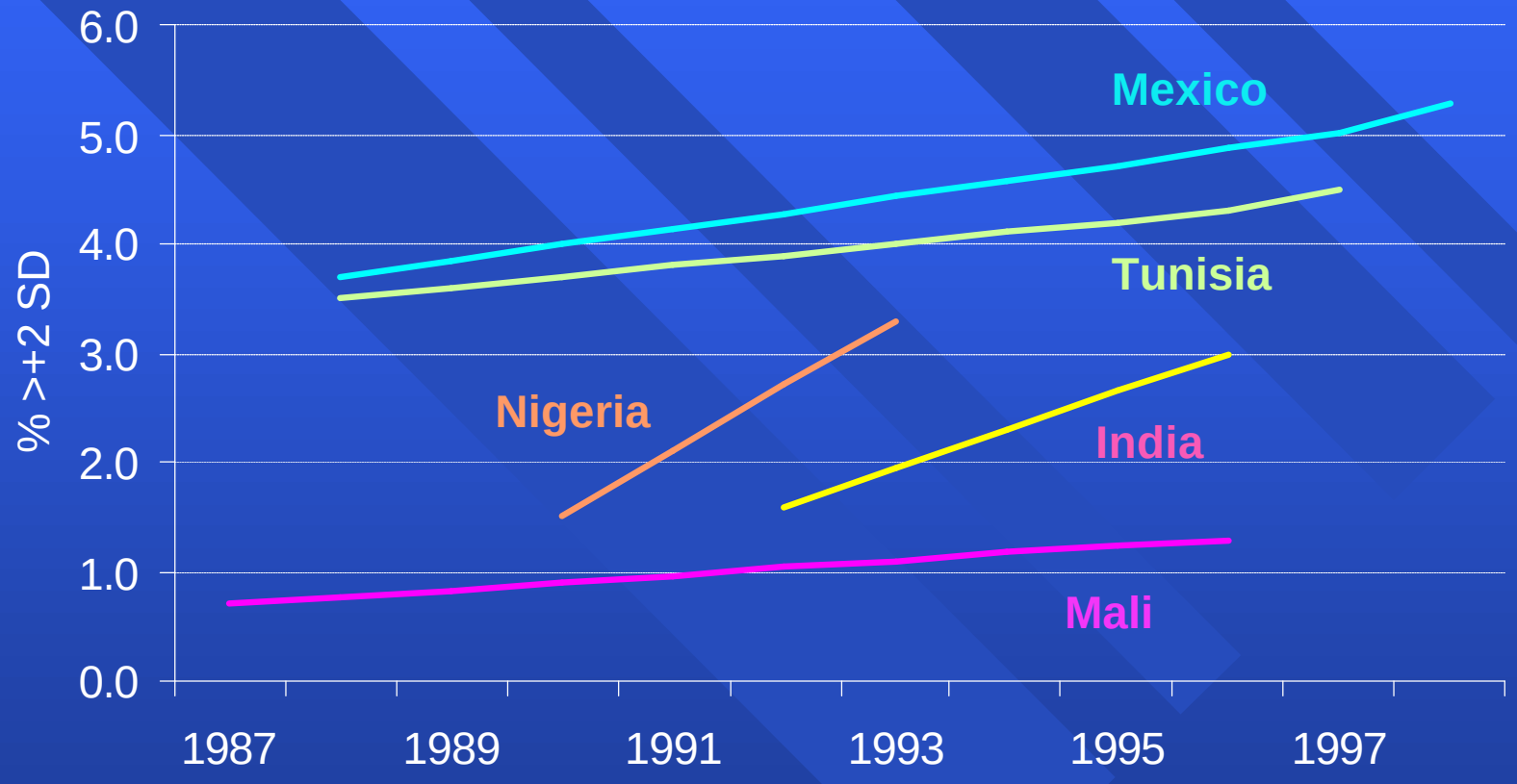
Overweight estimates in preschool children

Region	Overweight children (%)	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

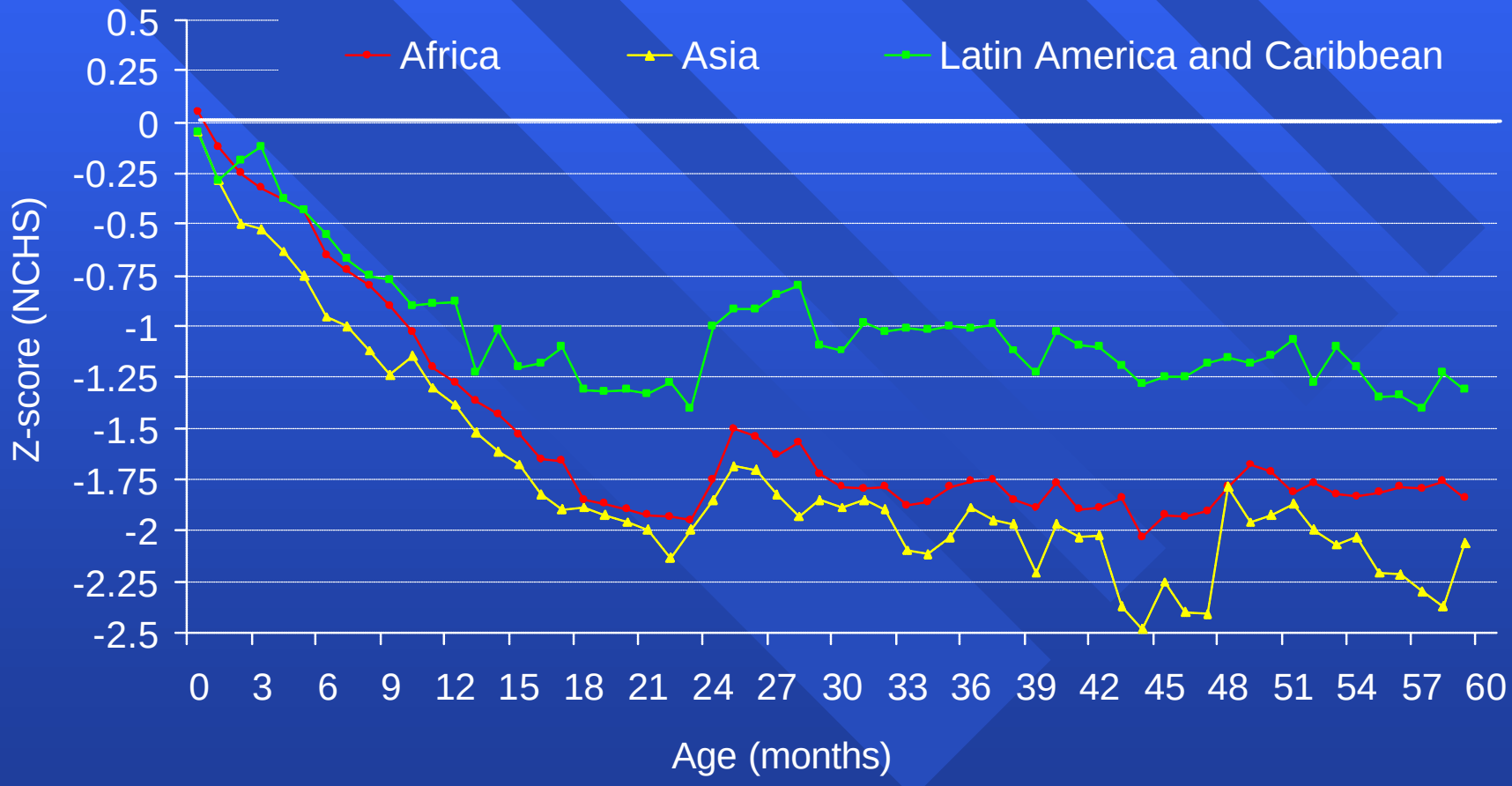
Trends of overweight in children



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).

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

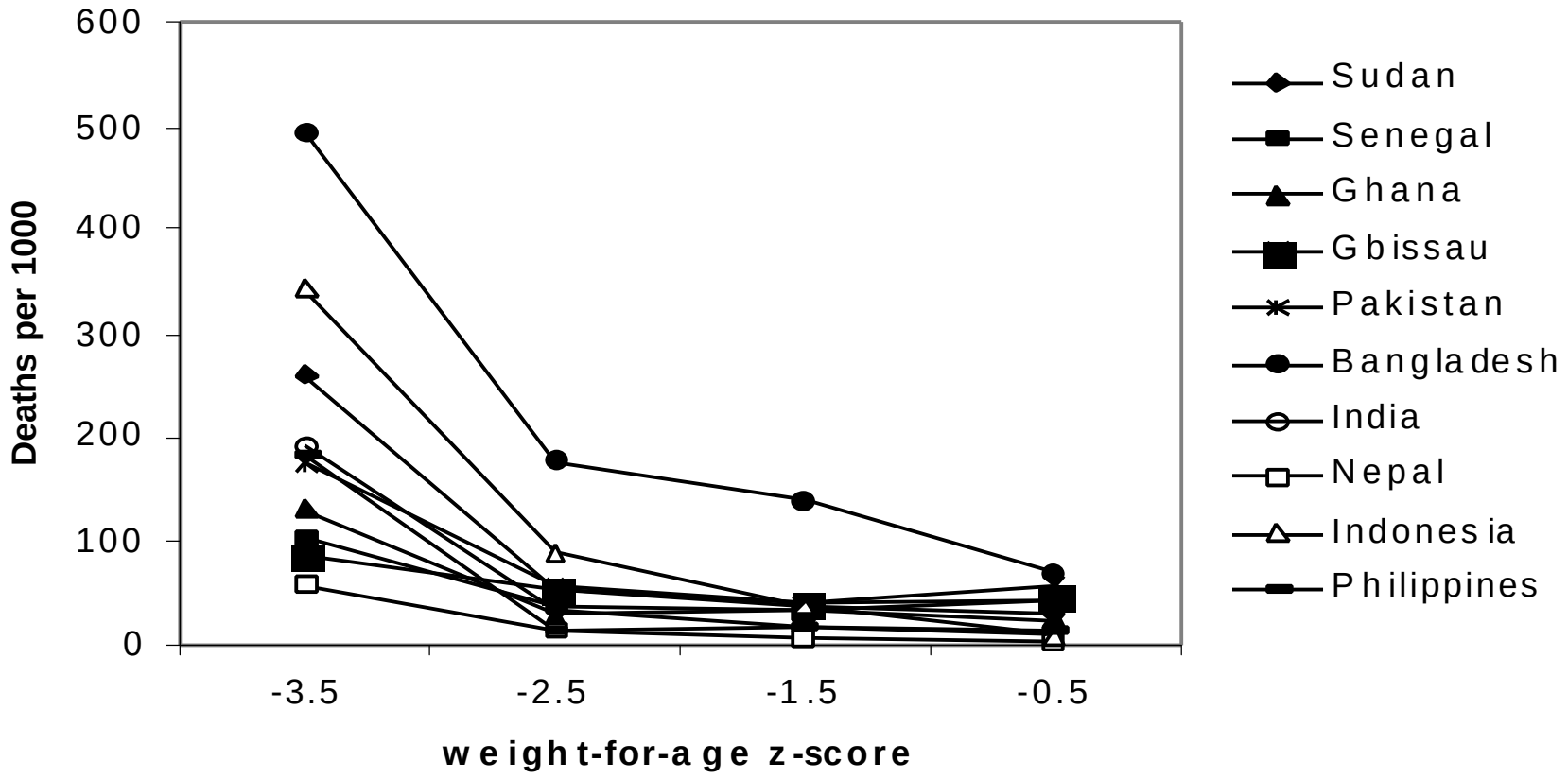
Source: Fishman S, Caulfield LE, de Onis M, et al. In: Comparative Quantification of Health Risks: The Global and Regional Burden of Disease due to 25 Selected Major Risk Factors. WHO/Harvard University Press, Cambridge, 2004 (in press).

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, 2004 (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, 2004 (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, 2004 (in press).

Total Burden of underweight status among children 0-4 years

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 o low birth weight only.

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

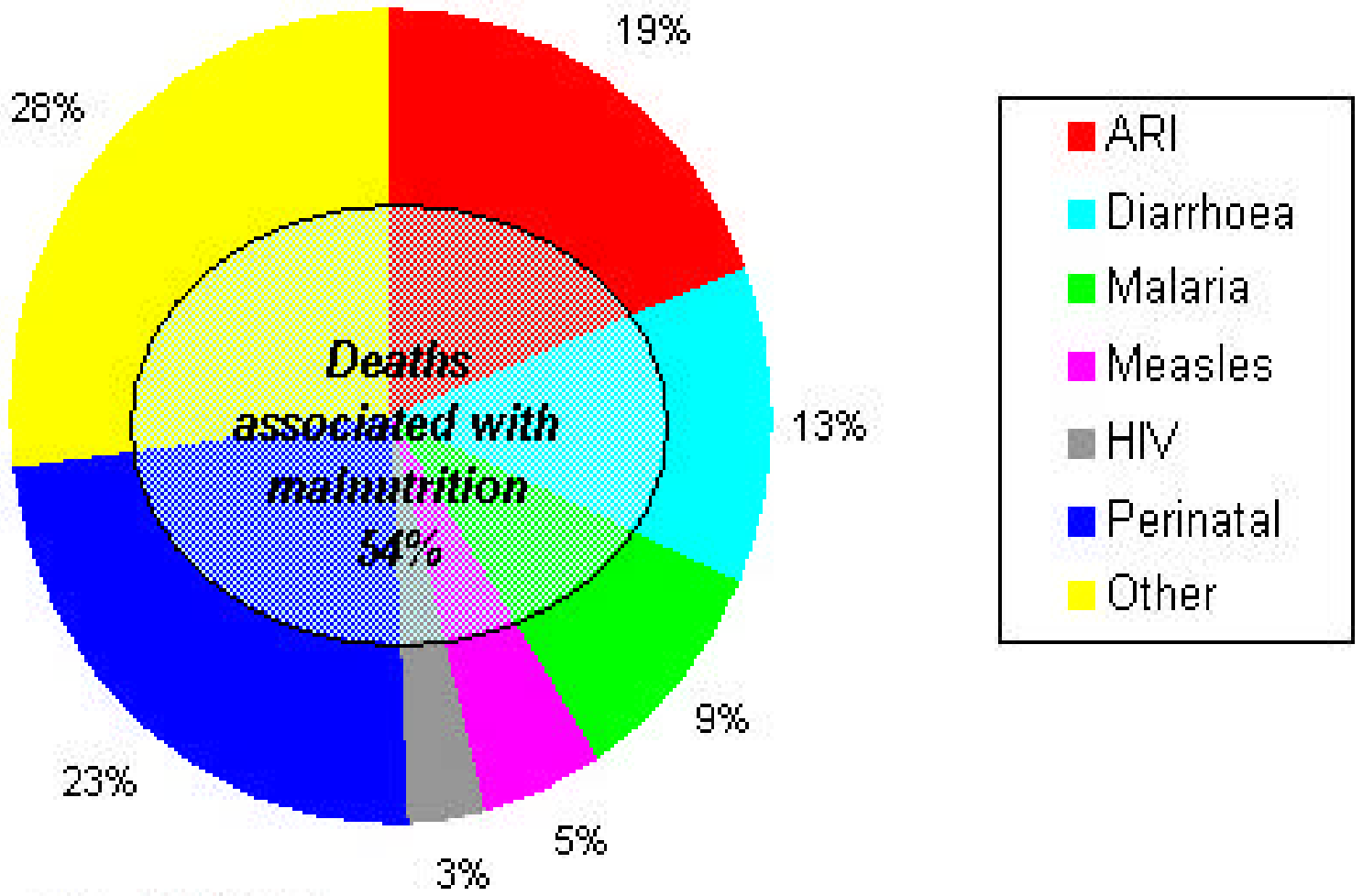
Source: Fishman S, Caulfield LE, de Onis M, et al. In: Comparative Quantification of Health Risks: The Global and Regional Burden of Disease due to 25 Selected Major Risk Factors. WHO/Harvard University Press, Cambridge, 2004 (in press).

Estimated burden of 10 leading risk factors

Rank	Risk Factor	DALYs (millions)	Global DALYs % total
1	**Underweight**	**138**	**9.5%**
2	Unsafe sex	92	6.3%
3	Blood pressure	64	4.4%
4	Tobacco	59	4.1%
5	Alcohol	58	4.0%
6	Unsafe water, sanitation, and hygiene	54	3.7%
7	Cholesterol	40	2.8%
8	Indoor smoke from solid fuels	39	2.6%
9	Iron deficiency	35	2.4%
10	Overweight	33	2.3%

Source: Ezzati A, Lopez AD, Anthony Rodgers, et al. Selected major risk factors and global and regional burden of disease. Lancet 2002;360:1347-60.

Distribution of 10.8 million deaths per annum among children < 5 years of age in developing countries, 2001



Sources:

For cause-specific mortality: EIP/WHO

For malnutrition: Pelletier DL, et al. AMJ Public Health1993, 83: 1130-3

Dissemination via internet

Bimonthly updates accessible at:

www.who.int/nutgrowthdb

+ 10040 registrations (May 1999 - Jan 2004)