



Pediatric Perspectives on International Adoption

Growth, Puberty and Long-Term Medical Risks



Nutrition Issues Specific to International Adoption

- Growth in children exposed to early deprivation.
- Growth suppression and recovery
 - Trajectories
 - Mechanisms
- Factors determining final height
- Long-term risks
 - Mental health
 - Chronic diseases
 - Life-span

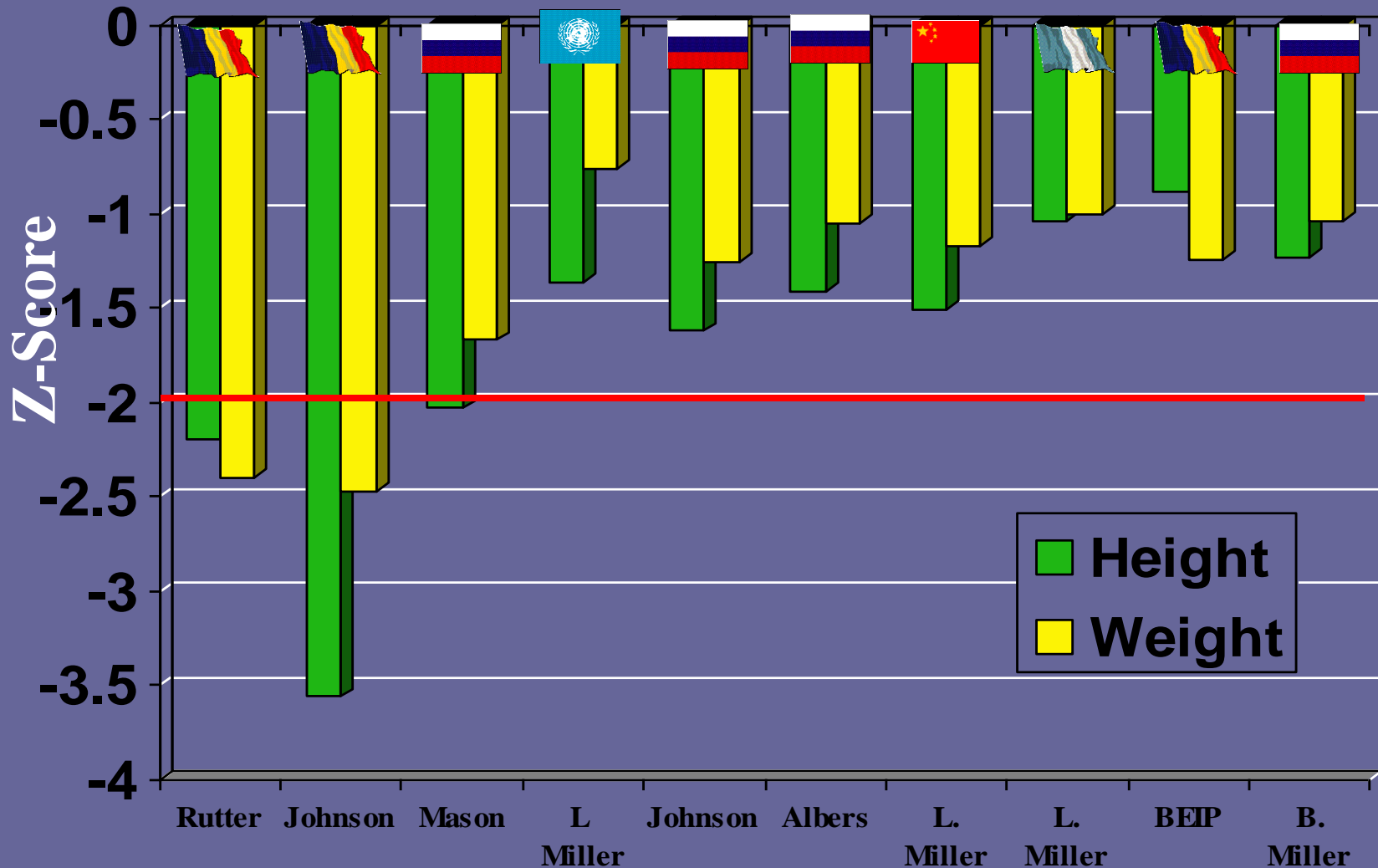
Growth Failure in Institutionalized Children



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Growth Failure in Institutionalized Children



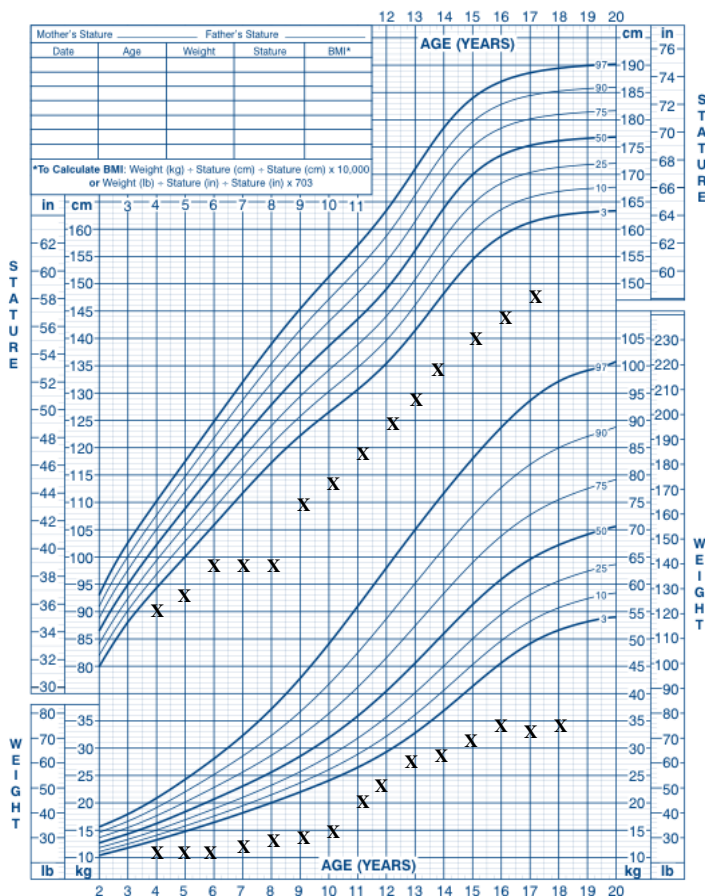


Profound Growth Failure In Institutionalized Children

2 to 20 years: Boys
Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



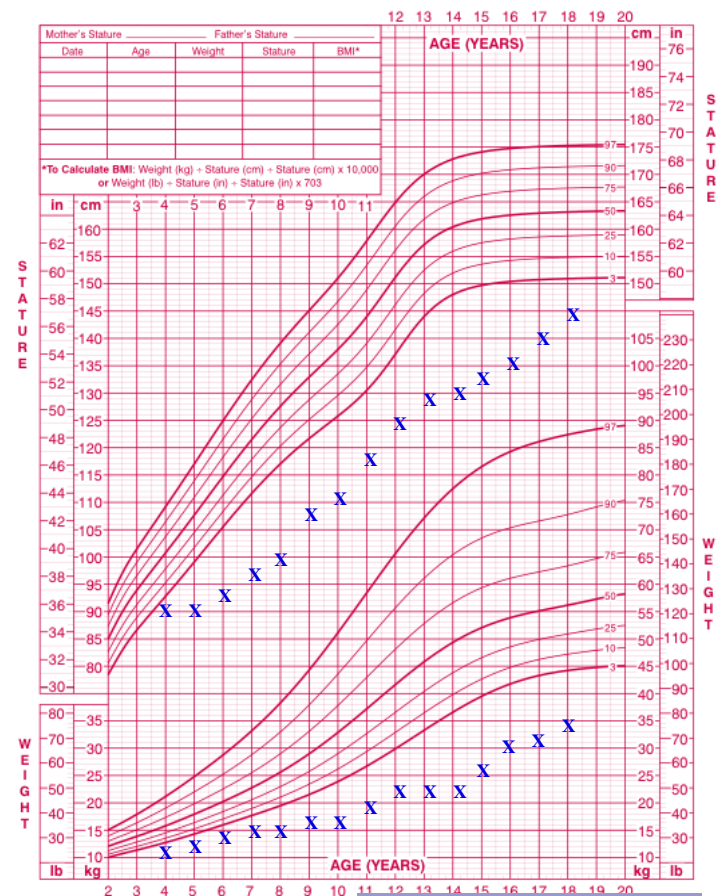
Published May 30, 2000 (modified 11/21/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with
the National Center for Chronic Disease Prevention and Health Promotion (2000).
<http://www.cdc.gov/growthcharts>



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n=262 133(f) 3-19 y



11 y girl



14 y girl



17 y girl

Nutrition and Institutional Growth Failure

- Available diet
 - Energy requirements are 20% higher in premature infants due to:
 - Higher basal metabolic rate
 - Lower coefficient of absorption for fat and carbohydrates
- Ability and desire to feed
 - Indifference (hospitalism)
 - Neuromotor problems, orofacial malformations
- Opportunity to feed
 - Not cue-based feeding—“efficiency-based”
- Inability to absorb substrate.

Summary: Growth Failure in Institutionalized Children

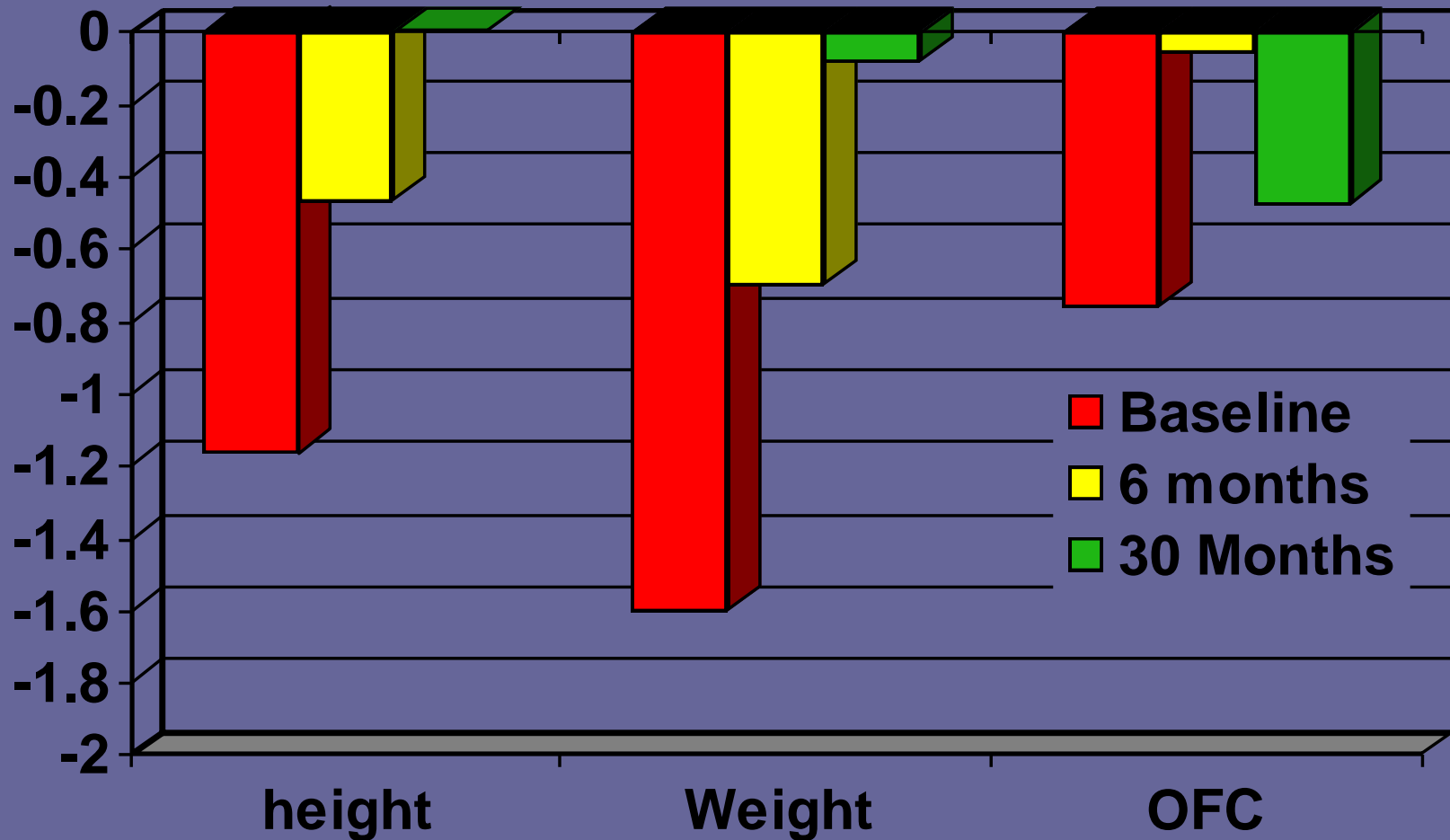
- All growth parameters affected
- Overall suppression rather than dose-dependent related to degree of deprivation.
- Underlying medical issues (LBW, FAS) exacerbate growth suppression.
- Mechanisms are somewhat age-dependent and involve nutrition and hypothalamic-pituitary-end organ suppression.



Catch-Up Growth

Post-Placement Catch-up Growth

Eastern European Growth Study, U of MN



Summary

Post-Placement Growth

- Rapid- Essentially Complete after 12 Months
- Most Dramatic Catch-up Growth
 - Younger at the Time of Arrival
 - Smaller at the Time of Arrival
 - Higher Quality Care after Arrival
 - Positive Regard
 - Sensitivity
 - Better Caloric Intake after Arrival
 - Recovery of the GH-IGF-1 axis
- Who Lags Behind at 6 Months?
 - Those most growth suppressed at arrival.
 - Older Children

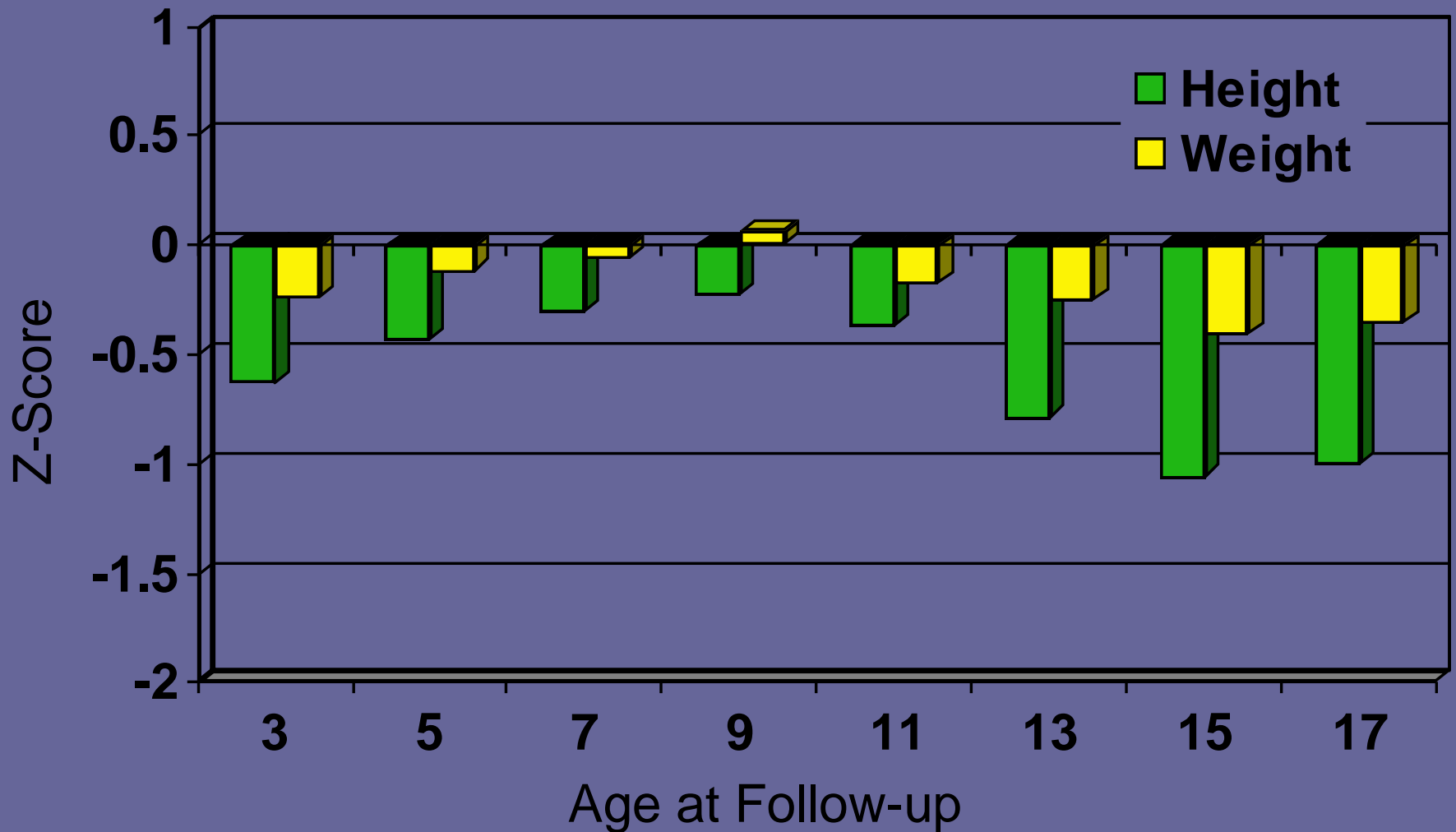
Long Term Recovery



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Follow-up Height and Weight



Why is Final Height Impaired?

- Parental Size???
- Prenatal growth impairment
- Postnatal growth impairment
- Earlier puberty (particularly girls)

Sex Differences

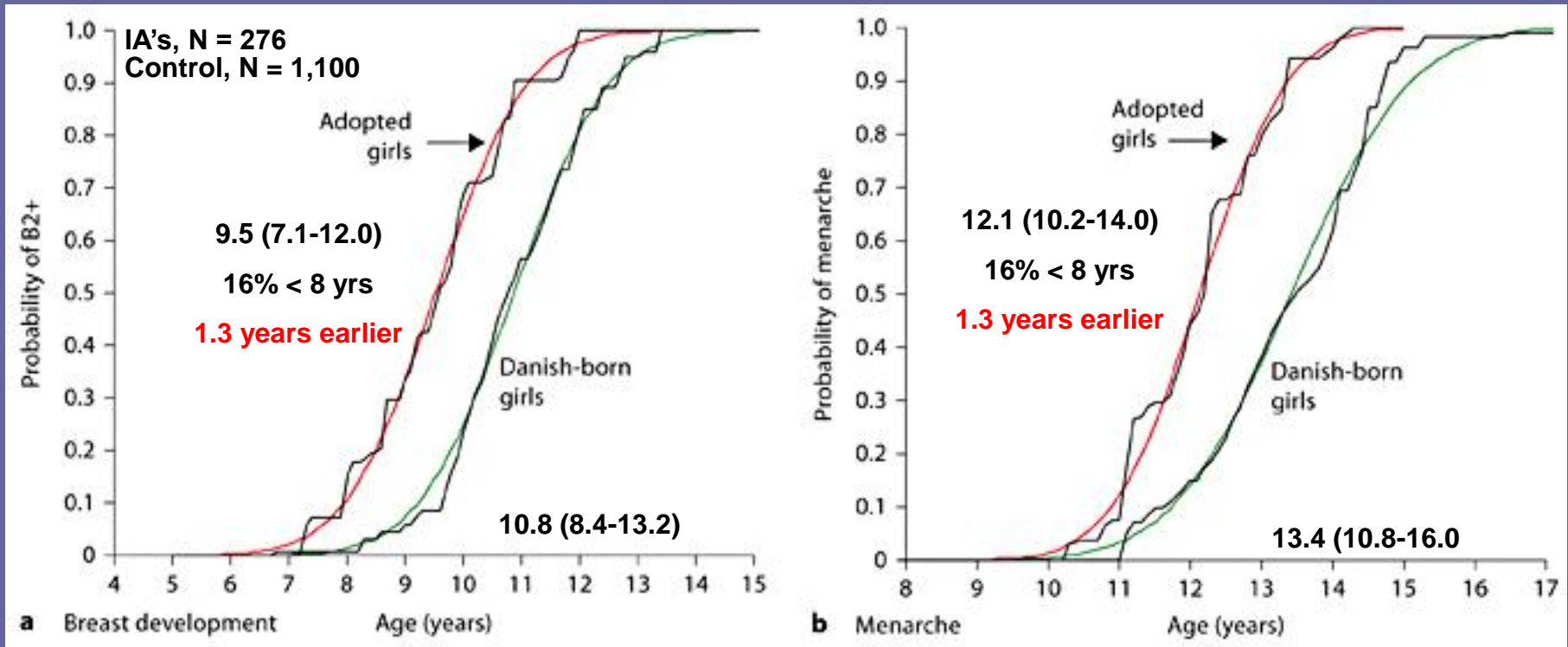
■ Boys

- In Utero Differentiation
- Early Postnatal Surge
- Dormant in Infancy
- Pubertal Activation
 - Later than in Girls
 - Testosterone
 - Genital Changes
 - Pubic Hair
 - Testicular Size
- Precocious Puberty < 9 years

■ Girls

- Minimal Activity in Utero
- Ovarian Activity Persists through Infancy
- Pubertal Activation
 - Earlier by 2 years
 - Estradiol and Progesterone
 - Breast Changes
 - Pubic Hair
 - Menses
- Precocious Puberty < 8 years

Age of Pubertal Changes in International Adoptees vs. Danish Girls



Management of Early Puberty

■ LHRH Agonists

- LHRH Agonists eliminate pulsatility

- Lupron

 - Depot Lupron, 3.75 to 11.25 mg im monthly

 - Desensitizes the HPG Axis

 - Does not impede Adrenal Androgen Production

- Supprelin LA Depot

 - Surgical implantation of a small plastic rod

 - Releases LHRH agonist daily over 12 months

 - Can be either removed or replaced

LHRH Agonist Treatment

- Successful in stopping central puberty
- Costs \$800 to \$2,000 per month
- Similar cost between Lupron and Supprelin
- Buys additional years of childhood
- Definite improvement in adult height when started before age 6
- Lack of agreement on when to start or stop
- No impairment of later reproductive function

SGA vs Institutionalized Children

SGA

- Growth Impaired early in life.
- Impaired growth hormone secretion/sensitivity
- Catch-up growth
- Early puberty especially girls
- Abnormalities in cortisol secretion
- **Metabolic Syndrome**
 - Obesity
 - Type II Diabetes
 - Hypertension
 - Cardiovascular disease

Institutionalized

- Growth Impaired early in life.
- Impaired growth hormone secretion/sensitivity
- Catch-up growth
- Early puberty especially girls
- Abnormalities in cortisol secretion
- **Metabolic Syndrome ???**
 - Higher BMI's

Stress and Adverse Outcomes

13,494 Adults in Kaiser Permanente HMO

■ Exposed to:

- Psychological Abuse
- Physical Abuse
- Sexual Abuse
- Household substance abuse
- Household mental illness
- Mother treated violently
- Household criminal behavior

■ ≥ 4 Categories

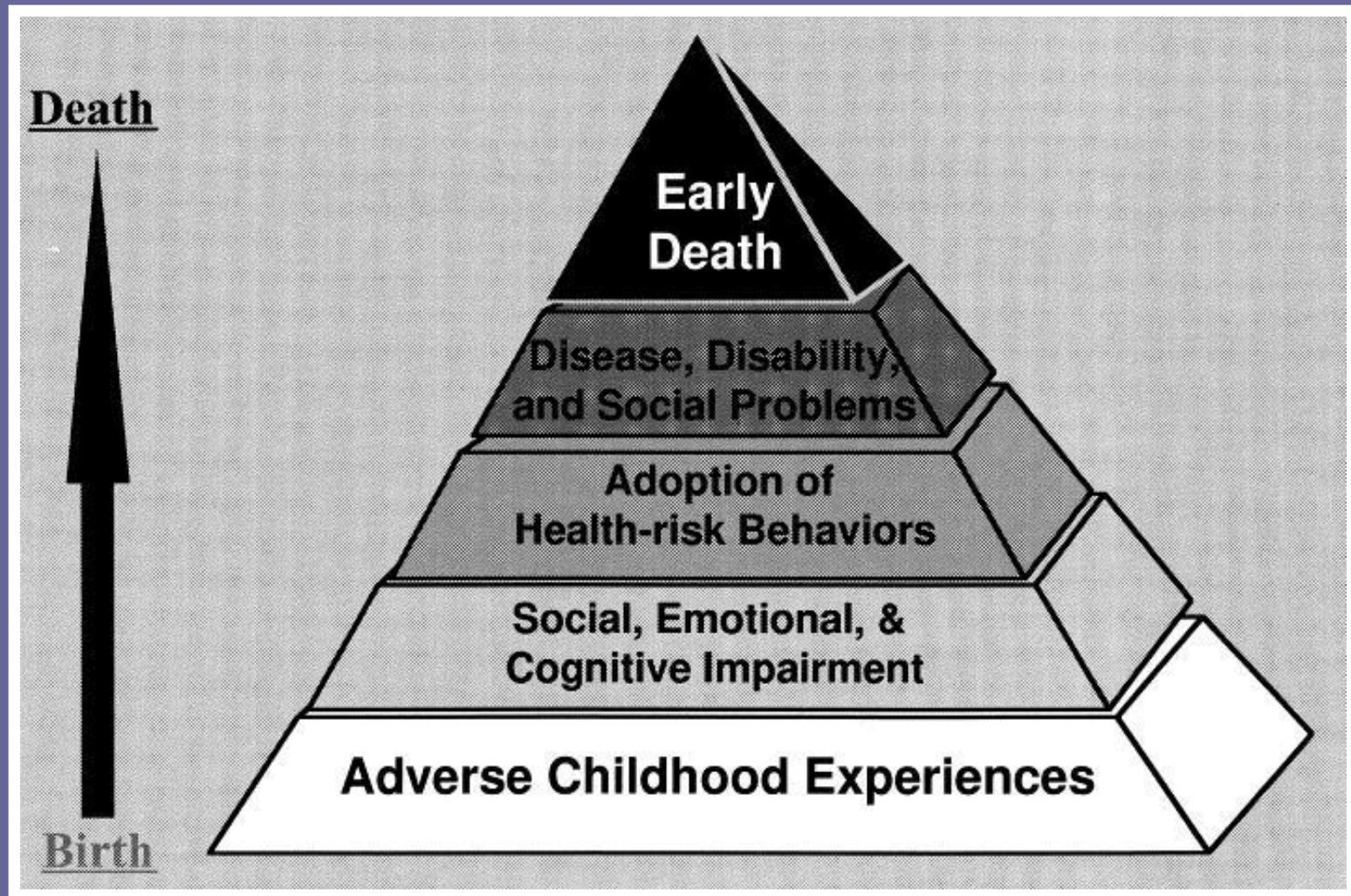
- Alcoholism 7.4
- Used illicit drugs 4.7
- Injected drugs 10.3
- ≥ 50 intercourse partners 3.2
- Sexually transmitted disease 2.5
- Ischemic heart disease 2.2
- Cancer 1.9
- Stroke 2.4
- Chronic bronch/emphy 3.9
- Diabetes 1.6

Stress and Adverse Outcomes

1193 Female Adults in Kaiser Permanente HMO

- Woman who experienced ≥ 4 exposures were 1.5 time more likely to have an unintended first pregnancy.
 - Strongest associations with
 - Frequent psychological abuse
 - Frequent physical abuse of the mother by her partner
 - Frequent physical abuse

Stress and Adverse Outcomes



Adverse Childhood Experiences, Allostasis, Allostatic Load and Age- Related Diseases

■ Brain

- Structural alterations in brain regions responsible for executive function, memory and emotional tone

■ HPA Axis

- Alterations in cortisol levels, normal diurnal variations and responsiveness

■ Immune System

- Elevated inflammation levels and altered response to infections.

Stress and Adverse Outcomes

Meta-analysis of 24 studies including 48,801 individuals

- Neurological Problems
 - Migraines
- Musculoskeletal Problems
 - Arthritis, broken bones
- Respiratory Problems
 - Asthma, bronchitis
- Cardiovascular Problems
 - Heart attack, stroke
- Gastrointestinal Disorders
 - Hernia, spastic colitis
- Metabolic Disorders
 - Diabetes, obesity
- Autoimmune Disorders

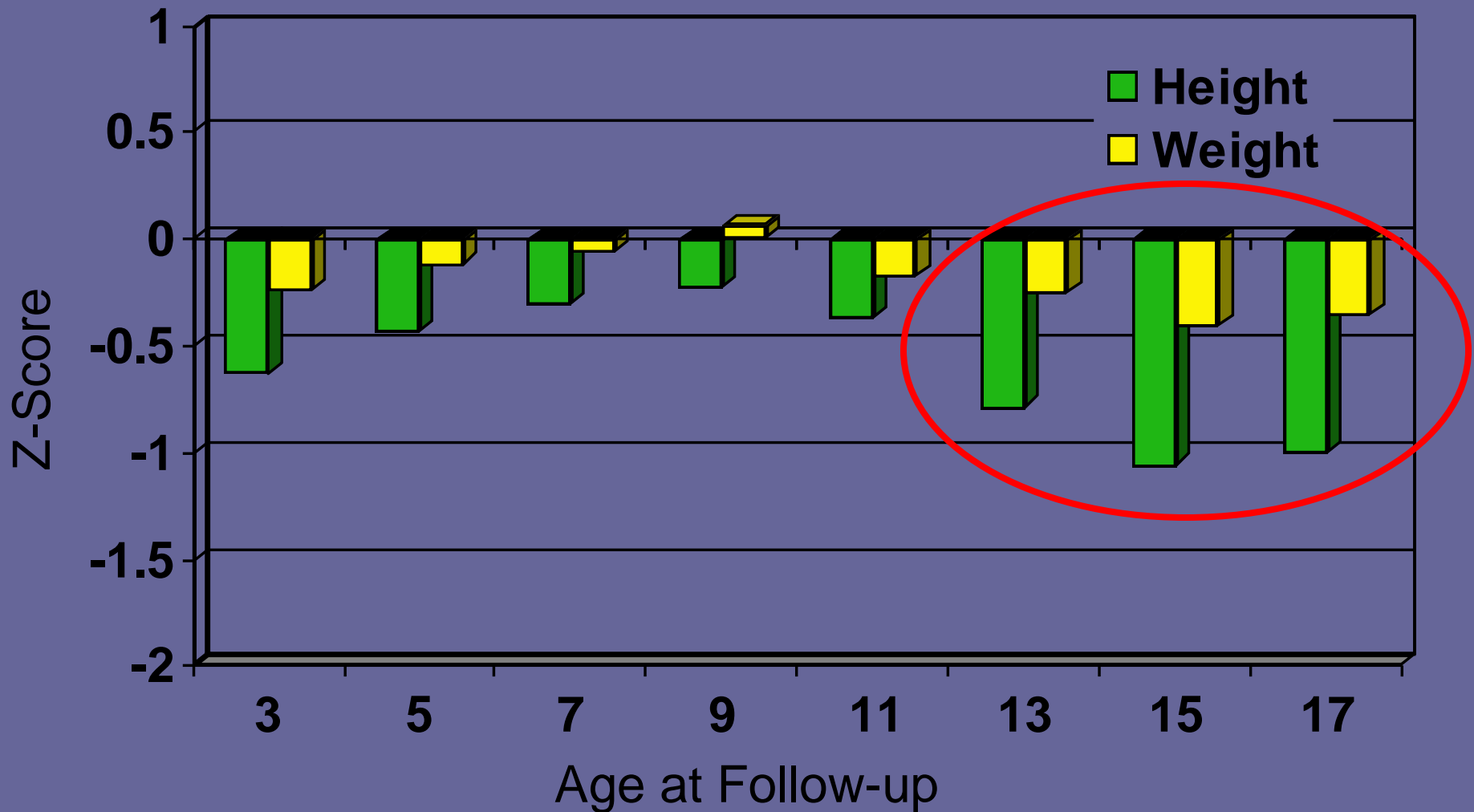
Stress and Adverse Outcomes

32 Year Prospective Study of 1037 New Zealanders

- Children exposed to adverse psychosocial experiences (maltreatment, social isolation) during the first decade of life were at elevated risk of depression, high inflammation levels and a clustering of metabolic risk factors [≥ 3 overweight, high blood pressure, high total cholesterol, low HDL cholesterol, elevated Hgb-A1C or low maximum oxygen consumption levels]

Dietz, et al, JAMA 1999; 282(14):1259-1364

IAP-Follow-up Height and Weight



Genome-Environment Interactions

- Telomeres-specialized nucleoprotein complexes located at the end of chromosomes that promotes chromosomal stability.
- Telomere length shortens with each successive cellular division.
- Once telomere length reaches a critical point, cell senescence is triggered, cell division ceases and the cell dies.
- Accelerated telomere length shortening has been associated with normative aging as well as cigarette smoking, radiation exposure, oxidative stress and psychological stress including a history of early maltreatment.

Telomere Length and Institutional Care

- Bucharest Early Intervention Project
 - Telomere length at 8 years of age was inversely related to the length of institutionalization.
 - Girls-length of institutionalization at baseline (22 months of age)
 - Boys-length of institutionalization at 54 months of age.

Stress and Adverse Outcomes

