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
Growth Failure in Institutionalized Children

![Graph showing Z-scores for height and weight for different individuals. The graph compares the deviations from the mean for height and weight across various individuals, highlighting significant growth failure.]
Profound Growth Failure In Institutionalized Children
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

Baseline
6 months
30 Months

height
Weight
OFC
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
Follow-up Height and Weight

![Bar graph showing Z-Score against Age at Follow-up for Height and Weight.](image-url)
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

IA’s, N = 276
Control, N = 1,100

9.5 (7.1-12.0)
16% < 8 yrs
1.3 years earlier

10.8 (8.4-13.2)

12.1 (10.2-14.0)
16% < 8 yrs
1.3 years earlier

13.4 (10.8-16.0)

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 elicit 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 $\geq 4$ 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.

Danese and McEwen Physiology and Behavior 2012;106:9-39
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]

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 teleomere length reaches a critical point, cell senescence is trigger, 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