Growth Faltering: Stunting and Severe Acute Malnutrition

Rebecca Stoltzfus, PhD
Professor
Division of Nutritional Sciences
Cornell University

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Growth Faltering

• Growth failure can involve linear growth retardation and/or wasting and is a short term adaptation to preserve vital functions.

• A child’s growth is used both clinically and in public health as a holistic measure of the child’s well-being and nutritional status.

Child Growth Is Assessed by Comparing to a Reference Curve

• Until 2004, a descriptive reference of US children was used:
  • how children do (did) grow in a representative sample.
  • New WHO growth reference is normative or prescriptive:
    • How children should grow
  • All 3500 children in the sample were carefully selected to come from educated, food-secure households, and mothers practicing WHO recommendations on breastfeeding and complementary feeding
  • An international reference: The WHO Multicenter Growth Reference Study

From 2 years and up, measure height

This is tricky business!
For children < 2 years, measure recumbent length

This is even trickier!
95% of the distribution lies between -2 and +2 Z

99.7% of the distribution lies between -3 and +3 Z

Z-score:

1. Measure length of child; find out age
   - Boy, 12 months, 69.6 cm long

2. From reference chart, find reference mean and standard deviation.
   - Mean: 75.5 cm; SD: 2.8 cm

3. Calculate Z-score
   - (69.6 cm – 75.5 cm) / 2.8 cm = -2.1

Summary of Most Common Anthropometric Measures:

- Height-for-age (length-for-age): The best for assessing populations.
  - Because children > 3 years generally don’t recover their lost height, a stunted child may be adequately nourished now, but malnourished in the past.
  - Stunting = HAZ < -2
- Weight-for-age: An easier proxy for HAZ
  - Underweight = WAZ < -2
- Weight-for-height:
  - Low scores tell you that child is underfed now.
  - Wasting = WHZ < -2
**Stunting: Inadequate Linear Growth**

- Considered a consequence of chronic undernutrition
- Measured as length or height for age and sex
  - Length up to 24 mo
  - Height thereafter
- Children can become stunted without ever becoming wasted (low weight for height)
- Therefore "invisible"

**Clinical Syndromes of Severe Acute Malnutrition (SAM)**

- **SAM** is a relatively new acronym for Severe Acute Malnutrition
  - Older term: severe protein-energy malnutrition (PEM)
- **Marasmus** is the predominant form throughout most developing countries. It is also the form that affects adults.
  - It is associated with:
    - Severe food shortage (or severely inadequate feeding of children)
    - Failure or early cessation of breastfeeding
    - Illness, especially diarrhea
- **Kwashiorkor** is less common, affects mostly children, and is most common in parts of the world where staple foods are excessively starchy (e.g. yam, cassava, sago)

**Marasmus**

Children with marasmus are usually apathetic

The Globe & Mail
July 10, 1998
Sudan

This slide summarizes signs and symptoms of PEM in an adult patient.

What does it look like in a young child?
Children with kwashiorkor are often actively miserable.

**WHO & UNICEF Joint Statement on the Identification of Severe Acute Malnutrition**

*Assigned reading for this lecture*

**Recommendation**

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1. Based on WHO standards [www.who.int/dtt/documents/standards](http://www.who.int/dtt/documents/standards)
2. Based on UNICEF standards [www.unicef.org](http://www.unicef.org)
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Wasting defined by weight-for-height requires two measurements—one of them very difficult.

Wasting defined by MUAC requires one simple measurement—you don’t even need to know age.

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Stunting
177 million children
Relative Risk of mortality: 2

Consequences of Stunting

- Child health consequences:
  - 14.5% of all child deaths
  - 12.6% of disability-adjusted life years in children < 5 y
- Social-economic consequences:
  - Decreased income
  - Decreased schooling
- Later health consequences:
  - High glucose, BP and adverse lipid profiles
  - For females: childbirth complications, mortality, and low birthweight babies
  - Short stature

SAM

Severe Wasting or SAM by wt-ht
19 million children
Relative Risk of mortality: 9

SAM diagnosed by low MUAC
7 million children
Relative Risk of mortality: 97

Quick Quiz
1. Is a stunted child skinny or short?
2. Is a wasted child skinny or short?
3. Is an underweight child skinny or short?
4. Which is at highest risk of death, a stunted child or a wasted child?
5. Which is at highest risk of death:
   - A SAM child diagnosed with low Wt/Ht,
   - or a SAM child diagnosed with small MUAC?

Functional Isolation Hypothesis

Characteristics of malnourished young mammals:
- Delay in psychomotor development
- ↑ in emotional reactivity
- ↑ in maternal protective behaviors (how?)
- ↓ in exploratory behavior & curiosity
- ↓ learning if there is no reward of immediate biological consequence

“The well-nourished animal is programmed with a hunger to learn all about its environment, not just its essential features. This hunger to learn is dramatically inhibited by malnutrition.”

Levitsky, 1979

When do wasting and stunting occur?

Figure recreated in Global Hunger Index, 2010. IFPRI
When do wasting and stunting occur?

When Do Wasting and Stunting Occur?

Stunting and Wasting Do Not Perfectly Coincide Geographically

% of Children with Stunting or Wasting (Z < -2) by Age in India (NFHS 3, 2005-2006)*

% of Children with Stunting or Wasting (Z < -2) by Age in Guatemala (RHS, 2008-2009)*

What are potential solutions?

What do you think about PlumpyNut as a solution?
### Divergent Programmatic Models

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$6 billion of $10 billion/yr requested by SUN Framework (World Bank)

(Bergeron & Castleman, Advances in Nutrition 2011 forthcoming)