

Growth Faltering: Stunting and Severe Acute Malnutrition

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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

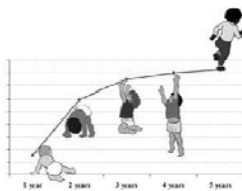


FIG. 1. WHO Multicentre Growth Reference Study map

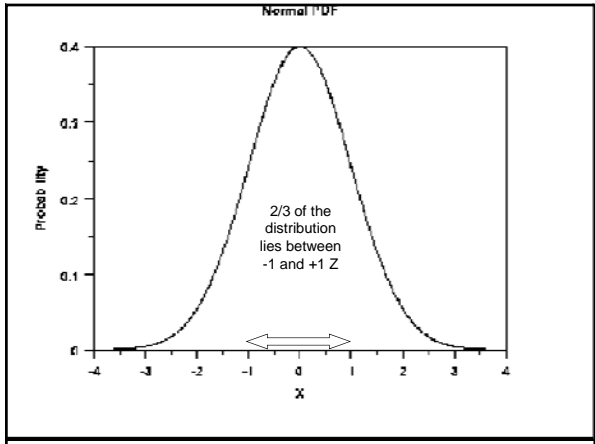
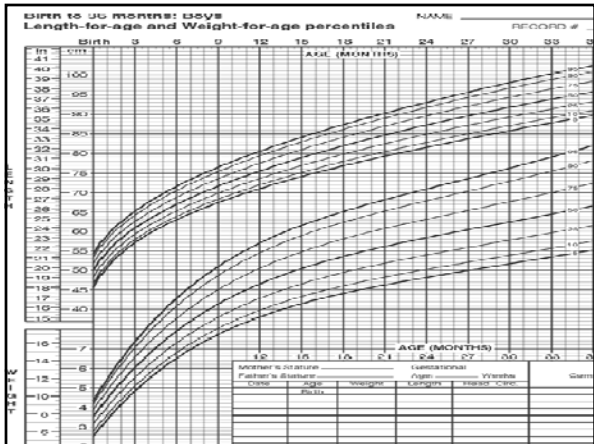
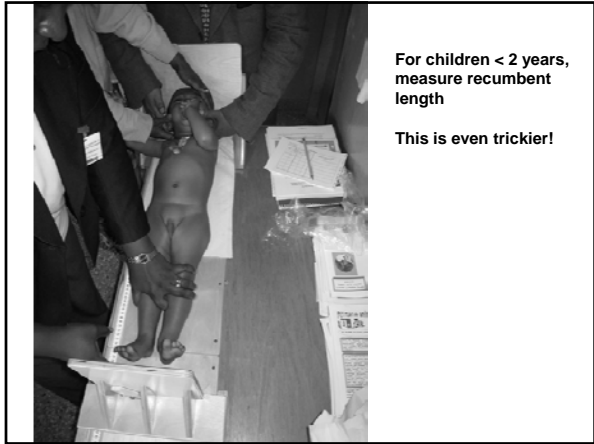
Well-nourished children in healthy environments grow very similarly all around the world.

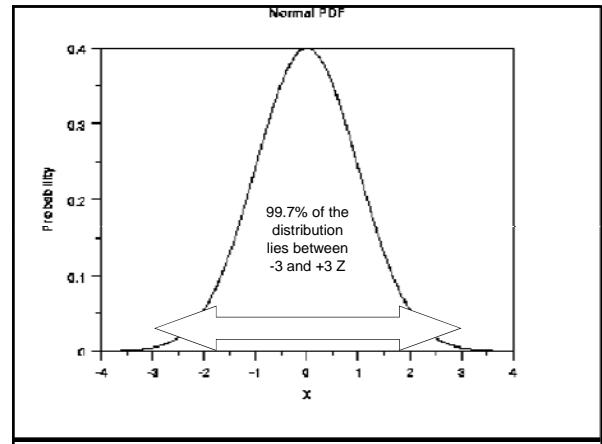
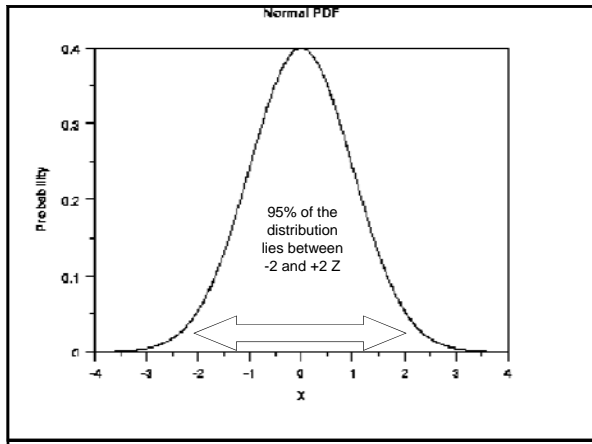


From 2 years and up,
measure height

This is tricky
business!

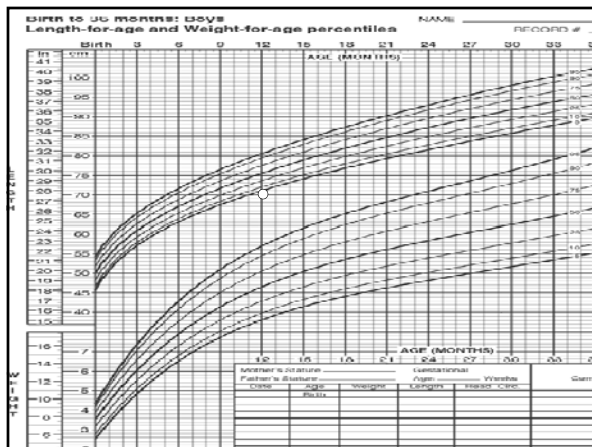
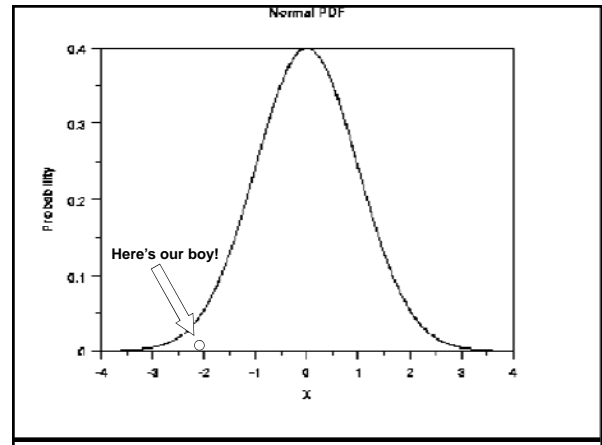






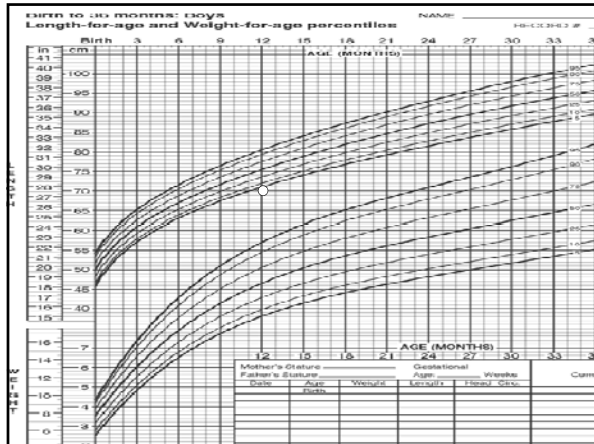
Z-score:
 (child value – mean reference value)
 ÷ standard deviation of reference distribution.

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
 – $(69.6 \text{ cm} - 75.5 \text{ cm}) \div 2.8 \text{ cm} = -2.1$



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

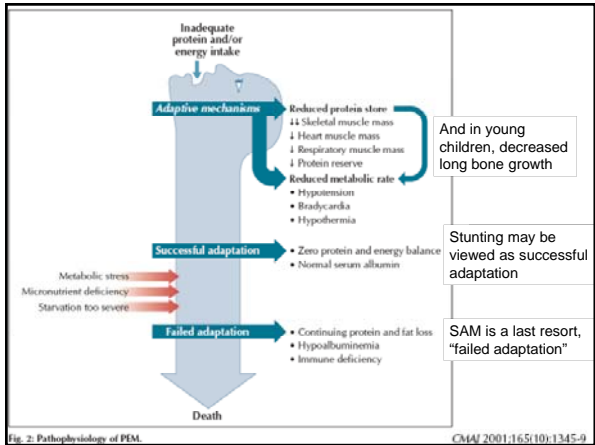
- Considered a consequence of **chronic** undernutrition
- Measured as length or height for age and sex
 - Length up to 24 mo
 - Height thereafter
- Children can become stunted without ever becoming wasted (low weight for height)
- Therefore "invisible"

105 cm 125 cm 100 cm

7 years 7 years 4 years

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)



- Reduced body weight
- Muscle wasting and decreased strength
- Reduced respiratory and cardiac muscular capacity
- Skin thinning
- Decreased metabolic rate
- Hypothermia
- Apathy
- Edema
- Immunodeficiency

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

What does it look like in a young child?

Fig. 1: Clinical features of PEM. PEM = protein-energy malnutrition.

Marasmus

Children with marasmus are usually apathetic

The Globe & Mail
July 10, 1998
Sudan



Kwashiorkor

Children with kwashiorkor are often actively miserable



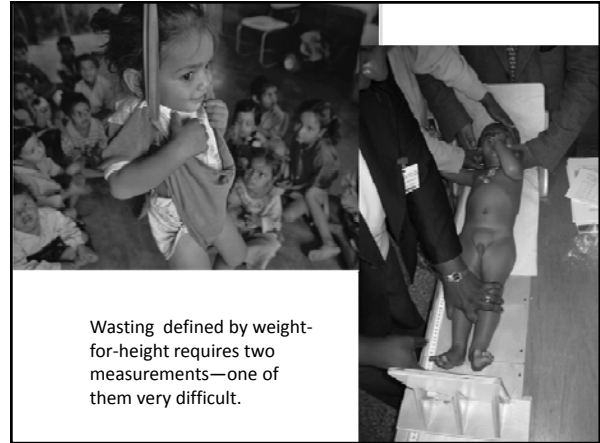
WHO & UNICEF Joint Statement on the Identification of Severe Acute Malnutrition (Assigned reading for this lecture)

Recommendation

BOX 1. DIAGNOSTIC CRITERIA FOR SAM IN CHILDREN AGED 6–60 MONTHS

Indicator	Measure	Cut-off
Severe wasting (2)	Weight-for-height (1)	< -3 SD
Severe wasting (2)	MUAC	< 115 mm
Bilateral oedema (3)	Clinical sign	

1. Based on WHO Standards (www.who.int/childgrowth/standards)
2,3. Independent indicators of SAM that require urgent action



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



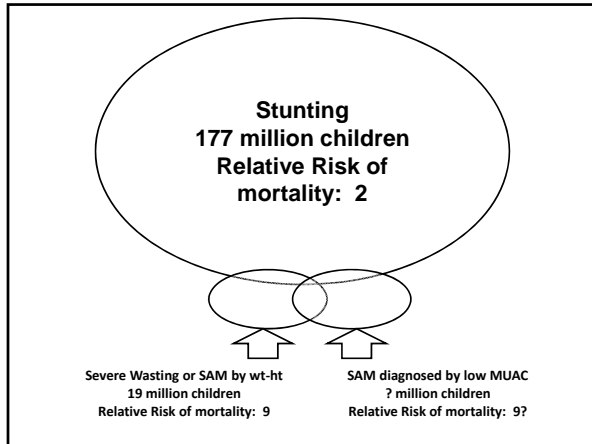
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- ### Consequences of Stunting
- 105 cm 125 cm 100 cm
- Child health consequences:
 - 14.5% of all child deaths
 - 12.6% of disability-adjusted life years in children < 5 y
 - Social-economic consequences:
 - Decreased income
 - Decreased schooling
 - Later health consequences:
 - High glucose, BP and adverse lipid profiles
 - For females: childbirth complications, mortality, and low birthweight babies
 - Short stature

Functional Isolation Hypothesis

Characteristics of malnourished young mammals:

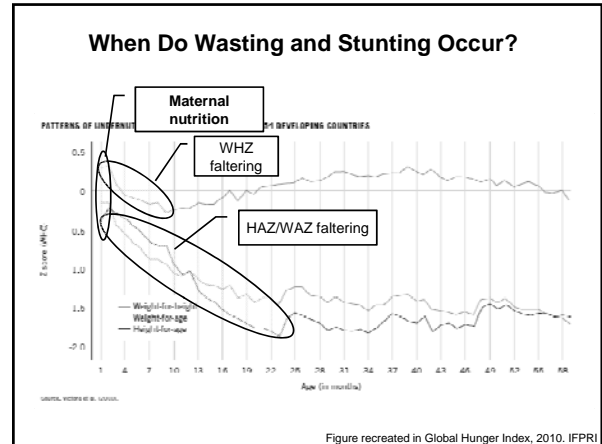
- Delay in psychomotor development
- ↑ in emotional reactivity
- ↑ in maternal protective behaviors (*how?*)
- ↓ in exploratory behavior & curiosity
- ↓ learning if there is no reward of immediate biological consequence

“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

- ### 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?



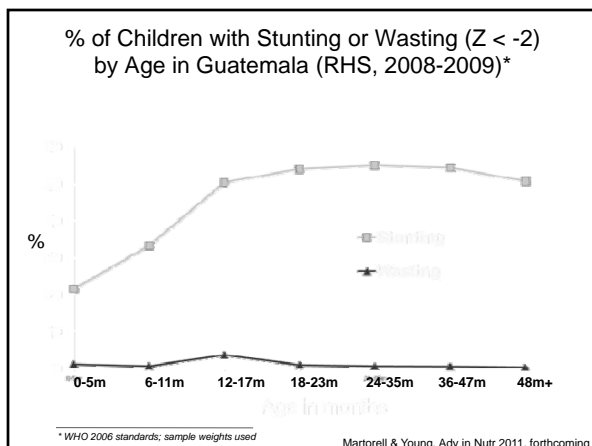
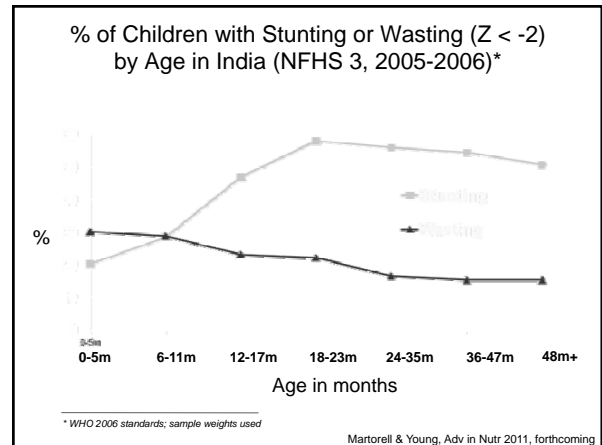


Stunting and Wasting Do Not Perfectly Coincide Geographically

		Wasting (<-2WAZ) (tercile)		
		Low	Mid	High
Stunting (<-2HAZ) (tercile)	Low	Armenia, Bolivia, Colombia, Dominican Rep, El Salvador, Jordan, Moldova, Swaziland	Azerbaijan, Ghana	Maldives
	Mid	Honduras	Congo (Brazza); Egypt; Kenya; Namibia; Sierra Leone; Uganda; Zimbabwe	Bangladesh, Guinea, Haiti, Mali
	High	Guatemala, Zambia	Benin, Cambodia	DRC; Ethiopia; India; Nepal; Nicaragua, Niger, Nigeria

Why are they not the same? Poor data? Or different underlying causes?

(Bergeron & Castelman, Advances in Nutrition 2011 forthcoming)



What are potential solutions?

What do you think about PlumpyNut as a solution?

Divergent Programmatic Models

ISSUE (Causes, Consequences)	PROGRAMS				
	Response models	Actors	Products	Delivery models	Indicators
SAM (Crises/rapid onset causes, lethal in the short term)	Medicalized treatment	Health sector, medically trained staff	RUTFs, Therapeutic milk	Screen and treat	Wt/Ht, MUAC
Stunting (Latent condition leading to long term physical impairment)	Preventive, multisectoral programs	Non-gov'tal organizations, Community health workers	Infant foods, home fortificants, Sanitation & handwashing, Education	Social protection, Community based programs	Ht/Age

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

(Bergeron & Castleman, Advances in Nutrition 2011 forthcoming)