Why body composition matters in infants: Catch up vs. accelerated growth

Presenter: Thomas Wallach, MD – SUNY Downstate Health Sciences University – Assistant Professor of Pediatrics

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Learning Objectives:

Recognize the importance of using Z-scores to identify abnormal growth patterns

Explain the consequences of failure to correct inappropriate growth patterns

Describe the difference between catch-up growth and accelerated growth

Notes:

Nutricia North America supports the use of breast milk wherever possible.

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Why body composition matters in infants: catch up vs. accelerated growth

Thomas Wallach, MD
SUNY Downstate Health Sciences University – Assistant Professor of Pediatrics

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Disclosures- Dr. Thomas Wallach

- Nutricia Early Experience Program Contributor
- Nutricia Speaker
- Advisory Board – Kiwi Biosciences
- PI – IBS trial – Ardelyx Pharmaceuticals
- ***None pose any conflict of interest for this presentation***

The opinions reflected in this presentation are those of the speaker and independent of Nutricia North America

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Learning Objectives

Participants in this activity will learn to:

- Recognize the importance of using Z-scores to identify abnormal growth patterns
- Explain the consequences of failure to correct inappropriate growth patterns
- Describe the difference between catch-up growth and accelerated growth

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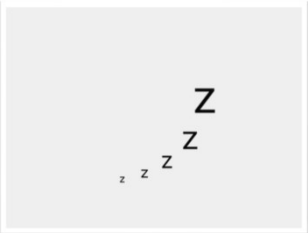
Zzzzzzzzzz



The common response when one starts a lecture out with statistics

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Poll Question

Do you feel confident in knowing the difference between Z-scores and percentiles?

A. Very confident
B. General idea
C. Not certain

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Z-Score

The representation of the number of standard deviations a measurement is above or below the mean value

Measurements above the mean are positive Z- scores

Measurements below are negative Z-scores.

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HAZ, WAZ, WFLZ or how I learned to love the acronym

- HAZ: Height for age Z-score
  - If <-2: stunted growth
- WAZ: Weight for age Z-score
  - If WAZ <-2: Underweight
  - If WAZ decreases by >1: Growth faltering
- WFLZ: Weight for length Z-score (age <2 years)
  - If WFLZ <-2: Wasting/Malnutrition
  - WFLZ < -3: Severe Acute Malnutrition (SAM)

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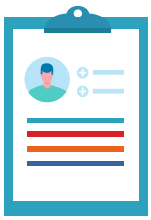
What's in a Z

Classic measures to establish malnutrition looked at percentage of the median. Z-score is substantially more sensitive.



A Work after WHO updated recommendation (2006) to screen for malnutrition with WFLZ scores noted:

1. *8-fold increase in classification of severe malnutrition*
2. Improved clinical outcomes

Isanaka et al, Pediatrics, 2009

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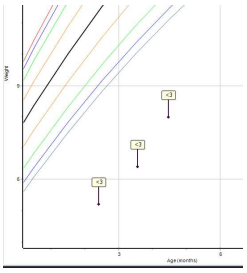
The problem with percentiles

Outliers

- Assessing improvement in low weight infants using a growth chart is … subjective
  - A 0.01% increase in percentile may represent a large increase in Z score in a very underweight child
- Same for overweight
- Z-score provides an easily understood quantitative measure to accurately measure trajectory



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We are not all supposed to be the same size.

For example, I'm the very large guy at a festival in Vietnam in 2011.

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HAZ, WAZ, Pizazz

HAZ and WAZ can be low or high and NOT represent malnutrition or overnutrition	Genetics
	Prematurity
	High HAZ will increase expected WAZ
WFLZ pulls the whole room together	Linear growth is preserved overweight gain
	Low WFLZ = acute caloric insufficiency (weight less than expected for length)
	High WFLZ = overnutrition (weight more than expected for length)

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Concerning growth patterns

- Severe Acute Malnutrition
- Stunted Growth
- Accelerated Growth
- Stunted Growth

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Severe Acute Malnutrition

- WFLZ <-3
- Substantial increased risk of mortality

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Accelerated Growth

Increase in weight or height Z-score of ≥ 1.0, when not preceded by growth faltering.

- can occur both spontaneously (e.g. in infants born SGA)
- can be driven by other risk factors

Catch-Up Growth in Infants and Young Children with Faltering Growth: Expert Opinion to Guide General Clinicians
Cooke et al. JPGN. July 2023 77(1):p7-15

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Abnormal Growth Patterns – Accelerated Weight Growth

- Typical: HAZ normal, WAZ high, WFLZ high.
- Implications:
  - Overfeeding: most common etiology, in infants typically formula/milk intake.
  - Pathology:
    - Endocrine: hypothyroid or metabolic regulatory disease (WAZ high, HAZ low-normal, WFLZ high)
    - Cardiac: fluid retention. WAZ normal-high, HAZ low, WFLZ high.
    - Hepatic: fluid retention/third spacing due to hypoalbuminemia. WAZ normal-high, HAZ low, WFLZ normal-high).

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Risk Factors for Nutritional Infant Obesity

- Absence of breast feeding
- Parental behaviors:
  - Food as reward
  - Pressure to eat
- Early introduction of complementary foods
- Maternal weight
- Antibiotic exposure

Rossiter et al, Maternal and Child Nutrition, 2021

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Accelerated Growth/Infant Obesity Outcomes:

- 29% of infants with WFLZ >2 are obese at age 2.
- Accelerated growth (WAZ increase > 1)
  - increased body fat deposition
  - Increased risk of obesity
  - Increased risk of metabolic complications when older

Roy et al, Pediatrics, 2016, Halilagic et al, Nutrients 2021

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Infant Accelerated Growth Interventions

- Avoid overly scheduled feeding, feed on demand
- Introduction of solids at >4 mo
- For >1 yo:
  - Regulate milk intake (<20 oz daily)
  - Stick to regular meal times and a snack
  - Do NOT calorie restrict.

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Abnormal Growth Patterns: Accelerated Height Growth

- As seen before, can be normal! Consider mid-parental height.
- Concerning patterns:
  - Rapid increase in HAZ, rapid decrease in WFLZ
    - Endocrine pathology (hyperthyroidism)
  - Rapid increase in HAZ and WAZ, WFLZ stable
    - Endocrine pathology (pituitary gigantism)

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Abnormal Growth Patterns: Growth Faltering and Stunting

- Growth faltering:
  - WAZ decreases by >1, WFLZ decreases, HAZ remains same
- Stunting:
  - WAZ low, HAZ low, WFLZ low-normal (linear growth sacrificed to protect brain)
  - Curveball: severe PEM can generate kwashiorkor, resulting in edema and artificially high WAZ. WFLZ can even appear high.

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Impact of Growth Faltering

- Impaired linear growth (stunting)
- Impaired educational and cognitive outcomes
- Decreased socioeconomic success

Mehta et al. *Journal of Parenteral and Enteral Nutrition*, 2013.

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Growth Faltering Interventions

- Consider supplemental formula for breast feeding infants
  - Undersupply is not uncommon
- Increase caloric intake (increased volume vs. increased caloric density)
- If >1 yo:
  - Consider supplemental formula
  - Consider periactin (appetite stimulant)
  - Avoid grazing behaviors

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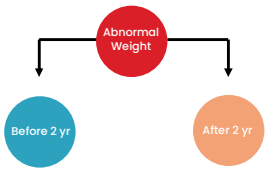
Growth Faltering and Accelerated Growth are Time Sensitive



Alderman et al, *PLoS One*, 2018

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2nd year life crisis

- Resolution of abnormal weight gain patterns before age 2 is highly effective
  - Resolved growth faltering prior to age 2 not associated with long term issues
  - Programs targeting childhood obesity risk factors in early infancy have suggested efficacy, although less well studied.

Cooke et al, JPGN, 2023, Blake-Lamb et al, American Journal of Preventative Medicine, 2017

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Growth Faltering and Accelerated Growth Causes?

- Almost always nutritional.
  - 80-95% of growth faltering is secondary to inadequate intake
  - Accelerated growth is less comprehensively studied, but primary risk factors are feeding related (formula feeding, early solid introduction)

Goodwin et al, American Family Physician, 2023, Mihrshahi et al, BMC pediatrics 2011.

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Poll Question

- Do you know the difference between catch-up growth and accelerated growth?

a. Yes, very confident between the two
b. Yes, I know there is a difference but need more information

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Catch-up Growth

Definition: Increased growth velocity following recovery from caloric restriction.

- Expected to see increased growth velocity during recovery from growth faltering
- Should slow at original weight for age Z-score (if available)

Catch-Up Growth in Infants and Young Children with Faltering Growth: Expert Opinion to Guide General Clinicians
Cooke et al. JPGN. July 2023 77(1):p7-15

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Catch up vs. Accelerated Growth

Recent focus on obesity → concern for incidence of accelerated growth with growth faltering

- Accelerated growth: Upward-centile crossing for weight for age w/o preceding faltering (A)
- Associated with increased risk of obesity and metabolic syndrome (B)

Necessary to be cognizant of overcorrection, but these are different phenomena and rapid weight gain in growth faltering (catch up growth) is not concerning

Druet et al, *Paediatric Perinatal Epidemiology*, 2012

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Goodwin et al, American Family Physician, 2023, Mihrshahi et al, BMC pediatrics 2011.

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