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1. For technical assistance, please use the chatbox
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Refeeding the Adult & Adolescent Eating Disorder Patient

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Introduction

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Objectives

- List 3 medical risks of malnutrition, regardless of body size, in a patient with an eating disorder.
- Define refeeding syndrome and assess refeeding syndrome risk in a patient.
- Explain how to determine expected body weight in the treatment of a patient with an eating disorder



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Outline

- Importance of Screening for Eating Disorders
- Risks of Malnutrition
- Assessment for Refeeding Syndrome
 - Brief Overview of Further Medical Assessment
- Determining Expected Body Weight
 - Case Vignettes

Importance of Screening for Eating Disorders

Eating Disorders Are Deadly

- Eating Disorders have the second highest mortality rate of all mental illnesses.
- 1 in 5 people diagnosed with Anorexia Nervosa die by suicide (Arcelus et. al, 2011).

Pre-Pandemic Eating Disorder Rates Had Doubled



- Eating Disorder 2019 Systematic Review Shows:
 - 2000 – 2006: 3.5% worldwide ED Rate
 - 2013 – 2018: 7.8% worldwide ED Rate
- OSFED is the most prevalent, followed by BED, BN and AN

(Galmiche et al. 2019)

Eating Disorders & the Pandemic



- Eating Disorder hospital related admissions April 2020 - March 2021, more than doubled the mean of the previous three years same time spans (Otto et. al, 2001).
- Eating disorders visits to the emergency department more than doubled during the pandemic (Radhakrishnan et al., 2022).



Eating Disorders Do Not Discriminate



Eating Disorders Affect:

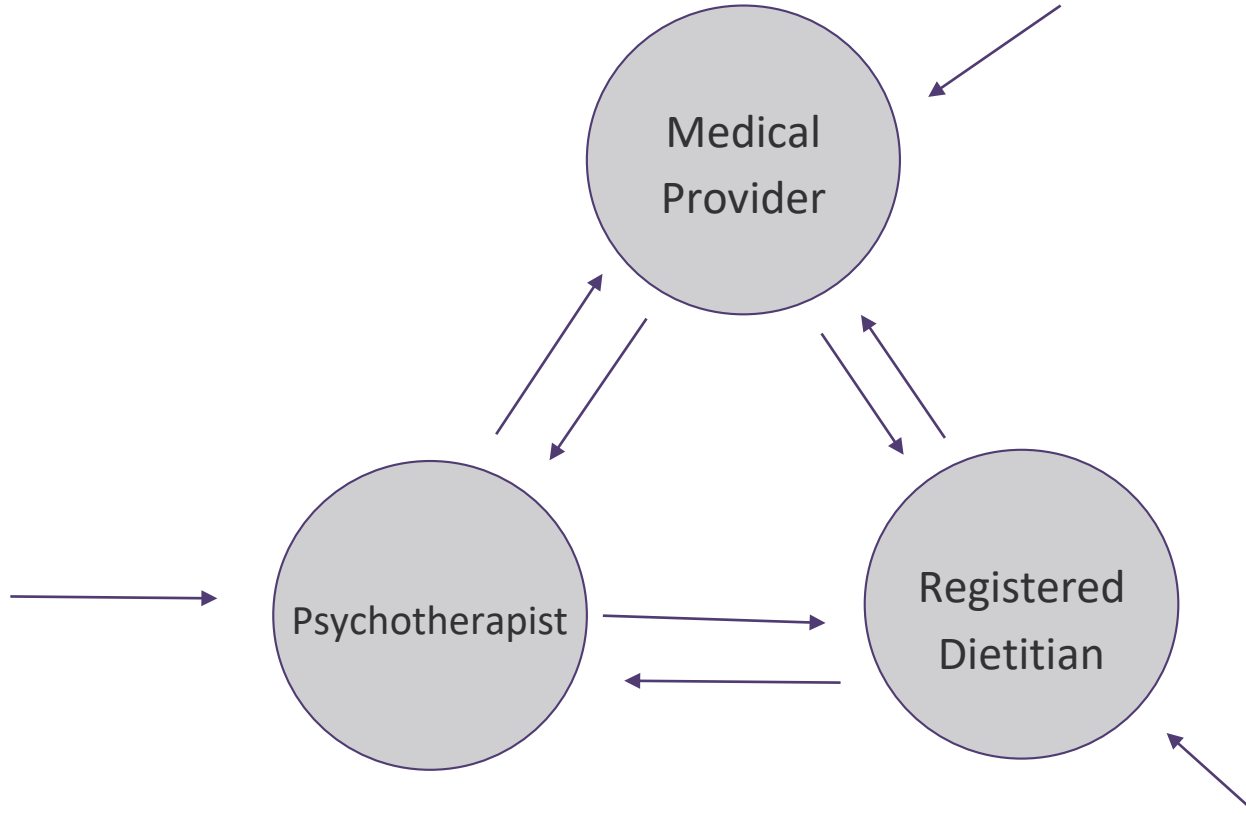
- All races
- All ages
- All socioeconomic backgrounds
- All genders
- All body types/sizes
- All sexual orientations

(Hornberger et. al, 2021; Sonnevile KR, Lipson SK. 2018; Mitchison et al, 2014, Flament, 2015)

Screening for Eating Disorders

- Adults:
 - NCEED's SBIRT-ED:
<https://eatingdisorderscreener.org/>
- Adolescents:
 - Hornberger et. al. 2021
 - Assess for:
 - dieting
 - body image dissatisfaction
 - experiences of weight stigma
 - changes in eating or exercise patterns
 - psychosocial development
 - amenorrhea
- Further training on Screening: NCEED Webinar Library

Identification of Eating Disorder



Malnutrition and the Risks

Definitions

- **Malnutrition:** lack of proper nutrition
- **Starvation:** severe deficiency in caloric energy
- **Refeeding syndrome:**
A range of metabolic and electrolyte alterations occurring as a result of the reintroduction and/or increased provision of calories after a period of decreased or absent caloric intake (da Silva, et al. 2021)
- **Refeeding/Nutrition Rehabilitation:**
The reintroduction of nutrition in a malnourished patient

What We Know About Starvation

- Minnesota Starvation Study
 - 36 male conscientious objectors up on a semi-starvation diet
 - One of few studies that evaluated symptoms of malnutrition and nutrition rehabilitation

- Refeeding Syndrome First described after WWII:
 - Prisoners of war, concentration camp survivors, and victims of famine



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Risks Associated with Malnutrition

- Cardiovascular:
 - Bradycardia
 - Orthostatic Instability
 - Congestive Heart Failure
- Digestive:
 - Gastroparesis
 - Slowed gi tract - diarrhea and/or constipation
- Endocrine:
 - Low sex hormones leading to low bone density
- Lymphatic:
 - Reduction of bone marrow production
- Hepatic:
 - Impaired liver function
- Skin, hair, and nails
- Psychological:
 - Anxiety
 - Depression
 - Hypervigilance
 - Body image distress
 - Suicide

Anorexia Nervosa & “Atypical” Anorexia

- DSM 5: Low weight is part of diagnostic criteria of Anorexia Nervosa
 - “in the context of the age, sex, developmental trajectory, and physical health (less than minimally normal/expected)”
- “Atypical” Anorexia:
 - client is not formally “underweight”
 - far more **typical**
 - Just as physiologically and medically ill as clients diagnosed with Anorexia Nervosa (Sawyer et al. 2016)
 - Calculate weight suppression

Refeeding Syndrome

- Times of Nourishment
- Times of Malnutrition
 - Efficiently use available energy stores
- Times of Severe Malnutrition
 - Vitamins and electrolytes become more depleted
 - Electrolyte depletion exacerbated by: diarrhea, vomiting, gastric drainage, diuretic use

(da Silva et al., 2020)

ASPEN Proposed Diagnostic Criteria for Refeeding Syndrome

- A decrease in any 1, 2, or 3 of serum phosphorus, potassium, and/or magnesium levels by 10%–20% (mild RS), 20%–30% (moderate RS), or >30% and/or organ dysfunction resulting from a decrease in any of these and/or due to thiamin deficiency (severe RS).
- And occurring within 5 days of reinitiating or substantially increasing energy intake/input.

Reintroduction of Nutrition after Severe Malnutrition

- Nutrition reintroduced:
 - Blood glucose increases
 - Insulin level increases
 - Insulin drives phosphorus and potassium into cells

Thus, phosphorus, potassium, and magnesium blood levels may drop sharply and can be fatal.

Phosphorus

- Vital Component of Adenosine Triphosphate (ATP)
 - Storage form of energy for humans
- During severe malnutrition, phosphate stores are used to produce ATP.
- Phosphate depletion can lead to muscle dysfunction and respiratory failure.
- Low serum phosphorus levels can lead to cardiac arrhythmias.
- Phosphorus depletion can lead to tissue hypoxia.

Potassium

- Insulin stimulates Na^+/K^+ ATPase
 - Na^+/K^+ ATPase - enzyme that stimulates K^+ into cell and Na^+ out
- Needed for nerve impulses and muscle contraction
- Hypokalemia -> impaired transmission of electrical impulses -> fatal cardiac arrhythmias
- Hypokalemia -> weakness, hyporeflexia, respiratory depression, and paralysis



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Magnesium

- Role in Refeeding Syndrome not fully understood
- Hypomagnesium impairs potassium reuptake in nephron -> may lead to excess losses
- Hypomagnesium impairs cellular transport of potassium



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Thiamin

- Thiamin deficiency also seen in refeeding
- Demand for thiamin increases during refeeding
 - Cofactor for glucose dependent metabolic pathways
- Thiamin deficiency → neurological abnormalities, oculomotor abnormalities,, hypothermia, coma, lactic acidemia, congestive heart failure, and other severe cardiac function abnormalities



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Patients at Risk for Reeding Syndrome

- Anorexia Nervosa
- Severe Mental Disorders
- Alcohol and Substance Use Disorders
- Bariatric Surgery and Bowel Resections
- Malabsorption
- Starvation in Protest, Famine or Migration
- Child Abuse and Starvation
- Military Recruits
- Athletes
- Renal Failure/Hemodialysis
- Critically Ill
- Malignancy
- Patients in the Emergency Department



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Refeeding



Increased glucose load leads to increased insulin secretion; Anabolism shifts back to carbohydrate metabolism and protein synthesis



- Increase in cellular uptake of glucose, K⁺, Mg, & phosphate
- Increase anabolic demands deplete already low stores
- Deficiency of phosphate hinders production of ATP and 2,3 diphosphoglyceric acid
- Impaired production and utilization of energy

(Runde & Sentogo, 2019)

Assessment for Risk of Refeeding Syndrome

ASPEN Criteria for Identifying **Adult** Patients at Risk for Refeeding Syndrome.



Moderate Risk (2 Criteria Needed)

- **BMI:** 16-18.5 kg/m²
- **Weight loss:** 5% in 1 month
- **Caloric intake:** None or negligible intake oral for 5-6 days
OR
<75% of estimated energy requirement for >7 days during an acute illness or injury
OR
<75% of estimated energy requirement for >1 month
- **Abnormal prefeeding Phos, K, and Mg:** Minimally low levels or normal current levels and recent low levels necessitating minimal or single-dose supplementation
- **Subcutaneous fat:** Evidence of moderate loss
- **Muscle Mass:** Evidence of mild or moderate loss
- **Higher Risk Comorbidities:** Moderate disease

ASPEN Criteria for Identifying **Adult** Patients at Risk for Refeeding Syndrome.



Severe Risk (1 Criteria Needed)

- **BMI:** $<16 \text{ kg/m}^2$
- **Weight loss:** $>7.5\%$ in 3 months or $>10\%$ in 6 months
- **Caloric intake:** None or negligible intake oral for $>$ days
OR
 $<50\%$ of estimated energy requirement for >5 days during an acute illness or injury
OR
 $<50\%$ of estimated energy requirement for >1 month
- **Abnormal prefeeding Phos, K, and Mg serum concentrations:**
Moderately/significantly low levels or minimally low or normal levels and recent low levels necessitating significant or multiple-dose supplementation
- **Subcutaneous fat:** Evidence of severe loss
- **Muscle Mass:** Evidence of severe loss
- **Higher Risk Co-morbidities:** severe disease

ASPEN Criteria for Identifying Pediatric Patients at Risk for Refeeding Syndrome.



Mild Risk (3 Criteria Needed)

- **Weight-for-length z-score or BMI-for-age z-score:** -1 to -1.9 z-score that is a change from baseline
- **Weight loss:** $<75\%$ of norm for expected weight gain
- **Energy intake:** 3–5 consecutive days of protein or energy intake $<75\%$ of estimated need
- **Abnormal prefeeding Phos, K, and Mg serum concentrations:** Mildly abnormal or decreased to 25% below lower limit of normal
- **High Risk comorbidities:** Higher-risk comorbidities
- **Subcutaneous fat:** Evidence of mild loss OR Mid-upper arm circumference z-score of -1 to -1.9 z-score

ASPEN Criteria for Identifying Pediatric Patients at Risk for Refeeding Syndrome.



Moderate Risk (2 Criteria Needed)

- **Weight-for-length z-score or BMI-for-age z-score:** -2 to -2.9
z-score that is a change from baseline
- **Weight loss:** $<50\%$ of norm for expected weight gain
- **Energy intake:** 5–7 consecutive days of protein or energy intake $<75\%$ of estimated need
- **Abnormal prefeeding Phos, K, and Mg serum concentrations:** Moderately/significantly abnormal or down to 25% – 50% below lower limit of normal
- **High Risk comorbidities:** Moderate disease
- **Subcutaneous fat:** Evidence of moderate loss OR Mid-upper arm circumference z-score of -2 to -2.9
- **Muscle Mass:** Evidence of mild or moderate loss OR Mid-upper arm circumference z-score of -2 to -2.9

ASPEN Criteria for Identifying Pediatric Patients at Risk for Refeeding Syndrome.



Severe Risk (1 Criteria Needed)

- **Weight-for-length z-score or BMI-for-age z-score:** -3 z-score or greater that is a change from baseline
- **Weight loss:** $<25\%$ of norm for expected weight gain
- **Energy intake:** >7 consecutive days of protein or energy intake $<75\%$ of estimated need
- **Abnormal prefeeding Phos, K, and Mg serum concentrations:** Moderately/significantly abnormal or down to 25% – 50% below lower limit of normal
- **High Risk comorbidities:** Severe disease
- **Subcutaneous fat:** Evidence of severe loss OR Mid-upper arm circumference z-score of -3 or greater
- **Muscle Mass:** Evidence of severe loss OR Mid-upper arm circumference z-score of -3 or greater

Initial Medical Assessment in Eating Disorder Treatment

Labs:

- **CBC with differential and platelets**
- **Comprehensive Metabolic Panel**
- **Additional Serum Tests:** Magnesium, Phosphorus, Cholesterol, Triglycerides, T3, T4, TSH, Serum HCG, Zinc, Ferritin, Vitamin D, Thiamin, B12, Folate, CK (with muscle aches/cramps), prealbumin
- **Testosterone and/or Estradiol levels –** With amenorrhea, prolonged weight loss or low intake greater than 9 months
- **Urinalysis**

Orthostatic Blood Pressure

Heart Rate – With prolonged weight loss or malnutrition the heart rate may be low at rest, but dramatically increase upon standing or walking across the room.

Electrocardiograph (EKG) – Necessary upon initial assessment of prolonged weight loss or malnutrition. Repeat EKG is needed if cardiac symptoms persist despite weight restoration or if new symptoms develop.

DEXA scan – Recommended with 3 months of amenorrhea, 6 months significant weight loss, and, in males, a low weight of 6 months or more.

Weight/Height measurements: consider blind weight

ASPEN Recommendations for Initiation of Calories

- Initiate with 100–150 g of dextrose or 10–20 kcal/kg for the first 24 hours; advance by 33% of goal every 1 to 2 days. This includes enteral as well as parenteral glucose.
- In patients with moderate to high risk of RS with low electrolyte levels, holding the initiation or increase of calories until electrolytes are supplemented and/or normalized should be considered.
- Initiation of or increasing calories should be delayed in patients with severely low phosphorus, potassium, or magnesium levels until corrected.

ASPEN Recommendations for Initiation for Electrolytes

- Check serum potassium, magnesium, and phosphorus before initiation of nutrition.
- Monitor every 12 hours for the first 3 days in high-risk patients. May be more frequent based on clinical picture.
- Replete low electrolytes based on established standards of care.
- No recommendation can be made for whether prophylactic dosing of electrolytes should be given if prefeeding levels are normal.



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ASPEN Recommendations for Initiation for Monitoring

- Recommend vital signs every 4 hours for the first 24 hours after initiation of calories in patients at risk.
- Cardiorespiratory monitoring is recommended for unstable patients or those with severe deficiencies, based on established standards of care.
- Daily weights with monitored intake and output.
- Evaluate short- and long-term goals for nutrition care daily during the first several days until the patient is deemed stabilized (eg, no requirement for electrolyte supplementation for 2 days) and then based on institutional standards of care.

Assessment for Risk of Refeeding Syndrome

- Assess risk for refeeding syndrome
 - ***chronically malnourished, severely underweight, has not eaten for 7-10 days (Mehler & Andersen, 2017)
 - Obtain electrolyte serum levels prior to nutrition rehabilitation
- At risk for RS?
 - Use ASPEN recommendations and APA level of care guidelines to determine appropriate level of care
- NOT at risk for RS? Or low risk?
 - Establish appropriate outpatient medical monitoring, depending on severity of restriction
- Family Based Treatment

Nutrition Rehabilitation in Outpatient Setting

- MD Correct electrolyte abnormalities before refeeding - best done inpatient
- Obtain serum electrolyte levels every day or other day for 7-10 days, then biweekly
- Increase intake by 300-400 calories every 3-4 days
 - Start at baseline or 20-25 kcal/kg/day
 - Increase calories until weight gain of 1-2# per week at minimum of weight restoration is needed
 - May need > 4,000 calories for weight restoration
- Ongoing medical monitoring:
 - tachycardia
 - edema

(Mehler & Anderson 2017)

Nutrition Rehabilitation in Outpatient Setting



- Balance protein/carbohydrates/fat
- Lower sodium: Insulin increases kidneys' reabsorption of sodium
- Delayed gastric emptying - use dense, lower volume foods as increase calories
 - Consider bowel regimen with fiber supplement and fluids
- Use liquid supplements, as needed

Supplementation

- Supplementation:
 - Multivitamin
 - Thiamin

Case Example- Kathy

- 11 yr, 10 mos, white female
- Mother concerned - eating disorder
- Recent refusal of meals and weight loss
- Patient denies trying to lose weight
- Mom presented to RD and had already started refeeding process



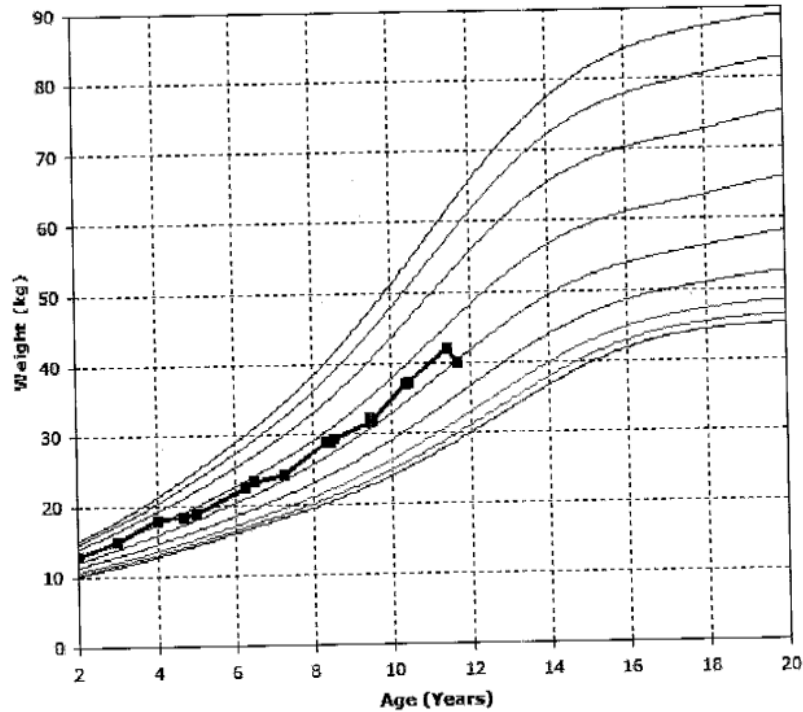
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Case Example- Kathy

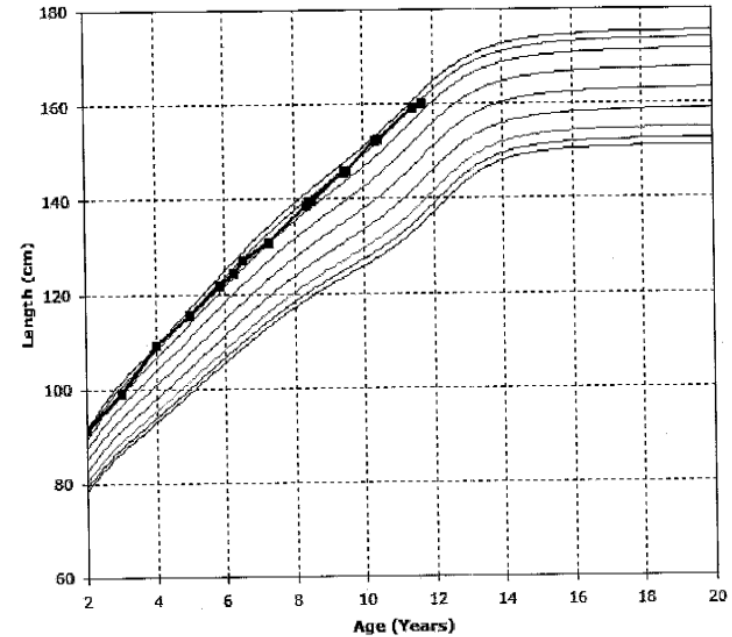


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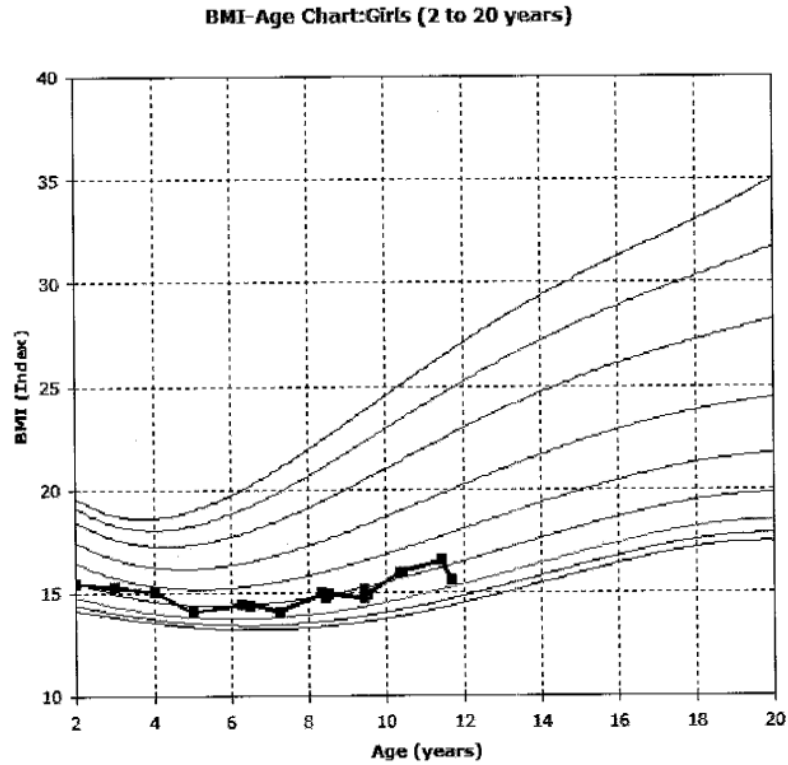
Weight-Age Chart: Girls (2 to 20 years)



Stature-Age Chart: Girls (2 to 20 years)



Case Example- Kathy



Case Example- Kathy

- Current weight: 87.6 lbs.
- 4.8 lb, weight loss in 3 months
- Expected body weight: ~96#
- $87.6/96 \times 100 = 91\%$ of EBW



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ASPEN Criteria for Identifying Pediatric Patients at Risk for Refeeding Syndrome.

Severe Risk (1 Criteria Needed)

- **Weight-for-length z-score or BMI-for-age z-score:** -3 z-score or greater that is a change from baseline **N/A**
- **Weight loss:** $<25\%$ of norm for expected weight gain **YES**
- **Energy intake:** >7 consecutive days of protein or energy intake $<75\%$ of estimated need **YES**
- **Abnormal prefeeding Phos, K, and Mg serum concentrations:** Moderately/significantly abnormal or down to 25% – 50% below lower limit of normal **Unknown**
- **High Risk comorbidities:** Severe disease **N/A**
- **Subcutaneous fat:** Evidence of severe loss OR Mid-upper arm circumference z-score of -3 or greater **N/A**
- **Muscle Mass:** Evidence of severe loss OR Mid-upper arm circumference z-score of -3 or greater **N/A**

Abnormal Initial Labs - Kathy

- **Phosphorus:** 3.6 mg/dL LOW
 - Normal Range: 4.1 - 6.6 mg/dL
- **AST:** 327 IU/L HIGH
 - Normal Range: 3-37 IU/L
- **ALT:** 189 IU/L HIGH
 - Normal Range: 20 - 50 IU/L



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Determining Expected Body Weight

Terminology

"Ideal Body Weight"

- 50th percentile weight-for-age
- 50th percentile BMI for age
- HAMWI

"Expected Body Weight"

"Treatment Goal Weight"

"Biologically Appropriate Weight"

- Historical weight, height
- Growth trajectory
- Pubertal stage
- Menstrual History
- Energy Intake and expenditure
- Extent client is malnourished
- Weight suppression

Determination of Expected Body Weight/Treatment Goal Weight

- Role of Physician and/or Registered Dietitian
- There is no gold standard to determine treatment goal weights (Lebow, 2018; Le Grange, 2012).
- Research vs. individual care

Determining Expected Body Weight

1. Evidence shows that even a small change of weight, as little as 5 pounds, can be the difference between having amenorrhea and having regular periods.
2. Evidence suggests "expected body weight" or "treatment goal weight" may need to be set 2kg above weight (or weight-for-age percentile) where menstruation stopped, or more for continued menstruation.

(Sterling et al, 2009; Faust et al 2013)

Weight Suppression

- Weight suppression: difference between current weight and highest weight
- Higher weight suppression associated with more severe eating disorders behaviors
- Higher weight suppression, less improvement in symptomatology

(Lowe et al, 2007; Berner et al, 2013)

Determining Expected Body Weight in Children and Adolescents

1. Assess historical growth history
 - a. Mark life events on growth charts
2. Has height-for-age crossed percentile lines?
3. Estimate EBW as a return to growth trajectory using weight-for-age
 - a. Determine for current age + 6 months
4. Establish EBW/Treatment goal weight as a minimum/range
5. Reassess every 3-6 months

Determining Expected Body Weight in Adults

- Assess medical and weight history:
 - Growth charts available?
 - Weight in high school?
 - Pregnancy history?
 - Dieting history?
 - Have menstrual cycles stopped - at what weight?
 - Weight suppression?
- Continue to reassess
- Caution of setting goal too low



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Full Weight Recovery is Important

- As little as 2.2kg has been shown to drastically reduce a person's risk of relapse (Arnold, 2013).
- Rate of weight gain has been shown to reduce risk of relapse (Lund et al., 2009).
- Negative energy balance contributor to an eating disorder (Arnold, 2013).

What if growth/weight history isn't available?

1. Are some plot points available?
 - a. Premorbid weight?
 - b. “Sick visits” at MD?
2. Defer determination of EBW
3. Focus on:
 - a. Normalizing eating patterns
 - b. Vital signs
 - c. Physical exam findings
 - d. Menstrual function
 - e. Laboratory findings
 - f. Absence of eating disorder behaviors

(Norris et al. 2019)

Signs of Nourishment

- Energy Level
- Regular menses
- Heart rate, blood pressure, body temperature in normal ranges
- Appropriate time spent thinking about food and body
- Regular, Adequate Sleep
- GI Function
- Health of skin and nails
- Normal lab values
- Decrease of eating disorder behaviors
- Hunger and fullness cues
- Social interaction



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Pediatric Case Example - Susan

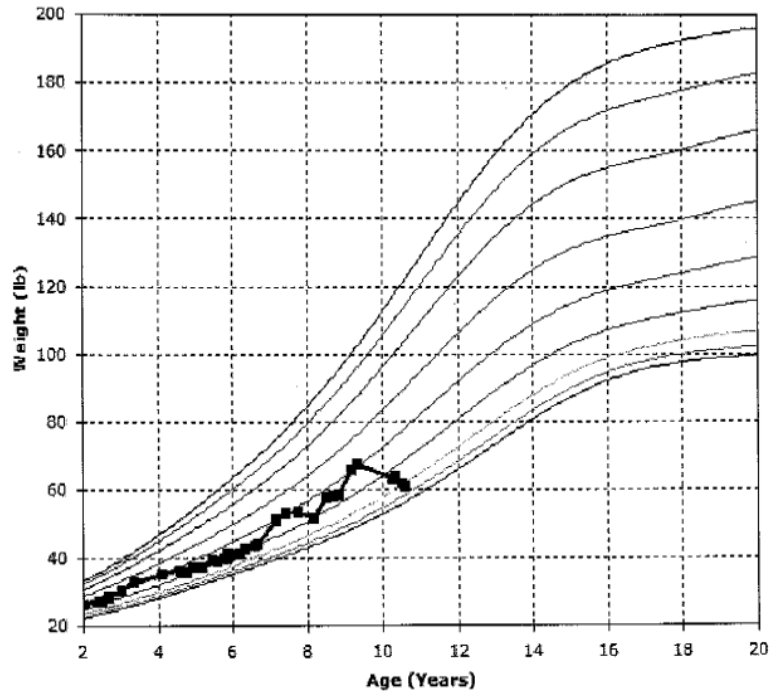
- Presented at 10 y 4 mos
- ~ 9 months of reported “healthy” eating
- Parents reported she was always a picky eater
- Increased outbursts, “behavioral” problems
- All labs: WNL
- No findings on EKG
- Prepubertal
- Weight-for-age: tracked 25-50th percentile 2 yo- present
- Height-for-age: ~10th percentile; jumped up during last 2 years to ~15th percentile
- 6.6# weight loss in 16 months

Case Example - Susan

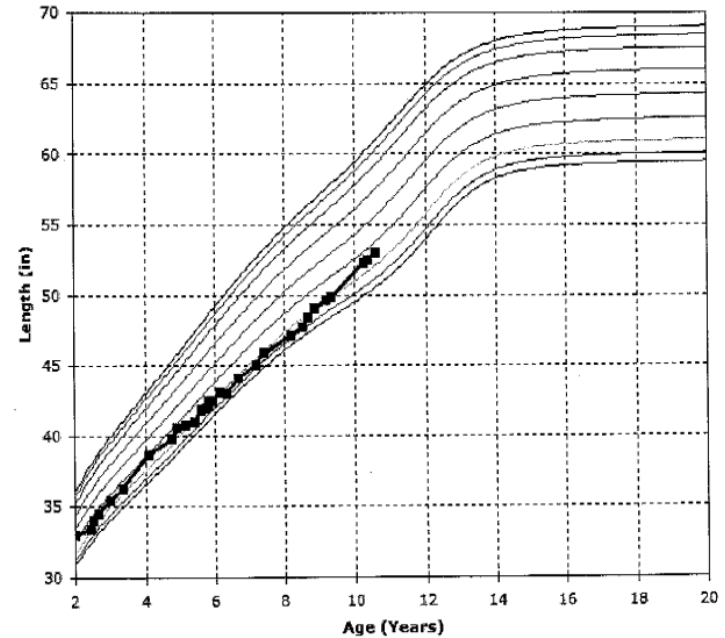


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Weight-Age Chart: Girls (2 to 20 years)



Stature-Age Chart: Girls (2 to 20 years)



Case Example - Susan

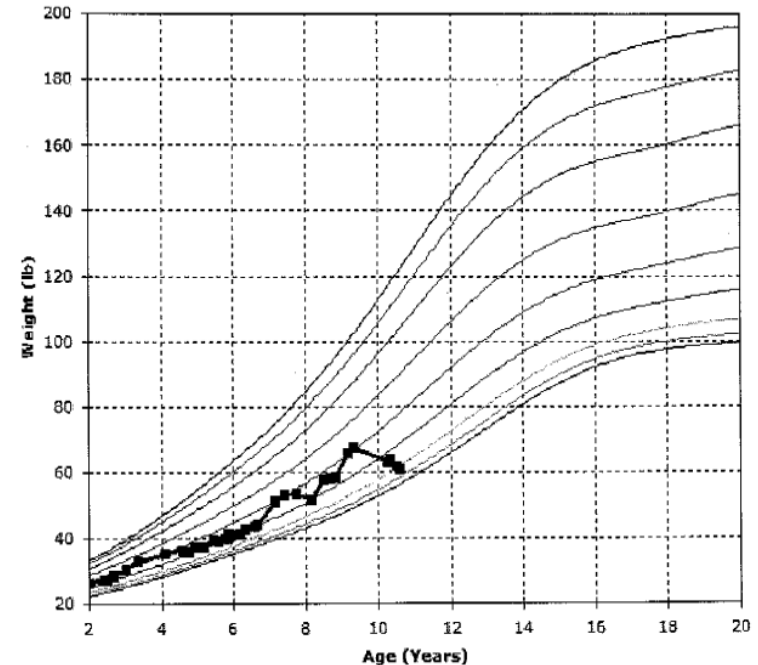


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- Current Weight:
 - 10y 4 mos: 60.8 lbs., 8.4% ile

- Expected Body Weight/Treatment Goal Weight
 - 10 y 10 mos: (6 months from intake)
 - 25th percentile: ~71lbs.
 - 50th percentile: ~80 lbs.
 - 11 y 4 mos:
 - 25th percentile: ~75 lbs.
 - 50th percentile: ~85 lbs.
 - 11 y 10 mos:
 - 25th percentile: ~79 lbs.
 - 50th percentile: ~90 lbs.

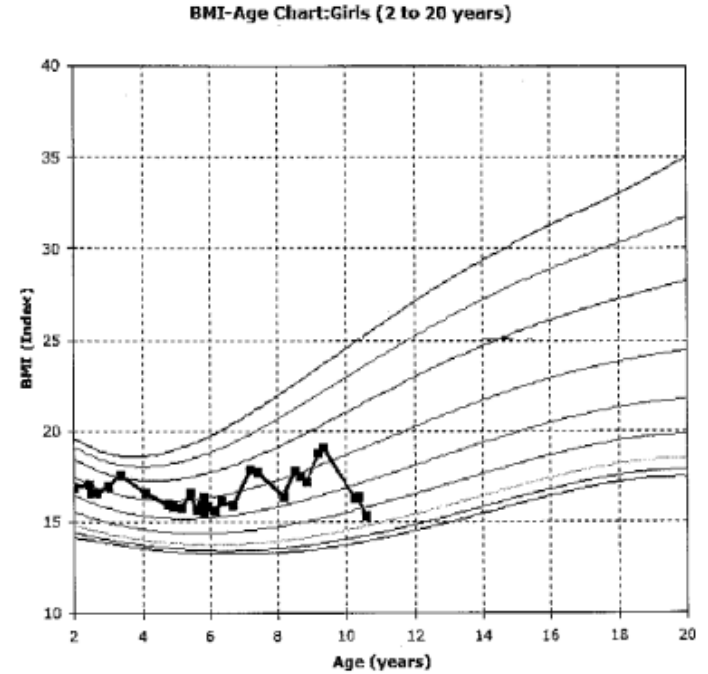
Weight-Age Chart: Girls (2 to 20 years)



Case Example - Susan

- Expected Body Weight/Treatment Goal Weight

- 10 y 10 mos:
 - Weight: 71 lbs - 80lbs.
 - Height: 54 in
 - BMI: 64%ile
- 11 y 4 mos:
 - Weight: 75 lbs - 85lbs
 - Height: 55.25 in
 - BMI: 65% ile
- 11 y 10 mos:
 - Weight: 79 lbs - 90 lbs
 - Height: 56.5
 - BMI: 65%



Adult Case Example - Millie

- Presented at 34 years
- 60# weight loss in last 9 months
- Current weight: 153#
- “Doctors have always told me I was overweight.”
- No period for 2 months
- Dieting off and on in college
- 1 pregnancy, 3 years ago
- “I had never lost the baby weight.”
- Started intermittent fasting about 9 months ago
- No history of prior eating disorder
- Parent with substance abuse history
- Trouble sleeping, headaches
- Episodes of heartracing/panic attacks?

Adult Case Example - Millie

- Height: 5'5"
- Self Reported goal weight per patient: 150#; (BMI <25)
- Weight senior year in high school (gym class): 163#
- Weight at end of college: 168#
- Prepregnancy weight 175# (~ 4 years ago) (age 30)
- Period stopped at 165#
- Estimated treatment goal weight: >170#

Signs of Nourishment

- Energy Level
- Regular menses
- Heart rate, blood pressure, body temperature in normal ranges
- Appropriate time spent thinking about food and body
- Regular, Adequate Sleep
- GI Function
- Health of skin and nails
- Normal lab values
- Decrease of eating disorder behaviors
- Hunger and fullness cues
- Social interaction



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Thank you!

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