

The Nutrition Care Process

Health Status and Nutritional Status

- Nutrition is important to promote health and prevent and treat disease statuses
- Adequacy of nutrient intake is important but does not completely describe nutritional status
- Determination of a person's nutritional status is also dependant on a wide variety of factors (biological, pathological, behavioral, cognitive, and environmental and systems)

Figure 2.1 Overview of the Nutrition Care Process and Standardized Language

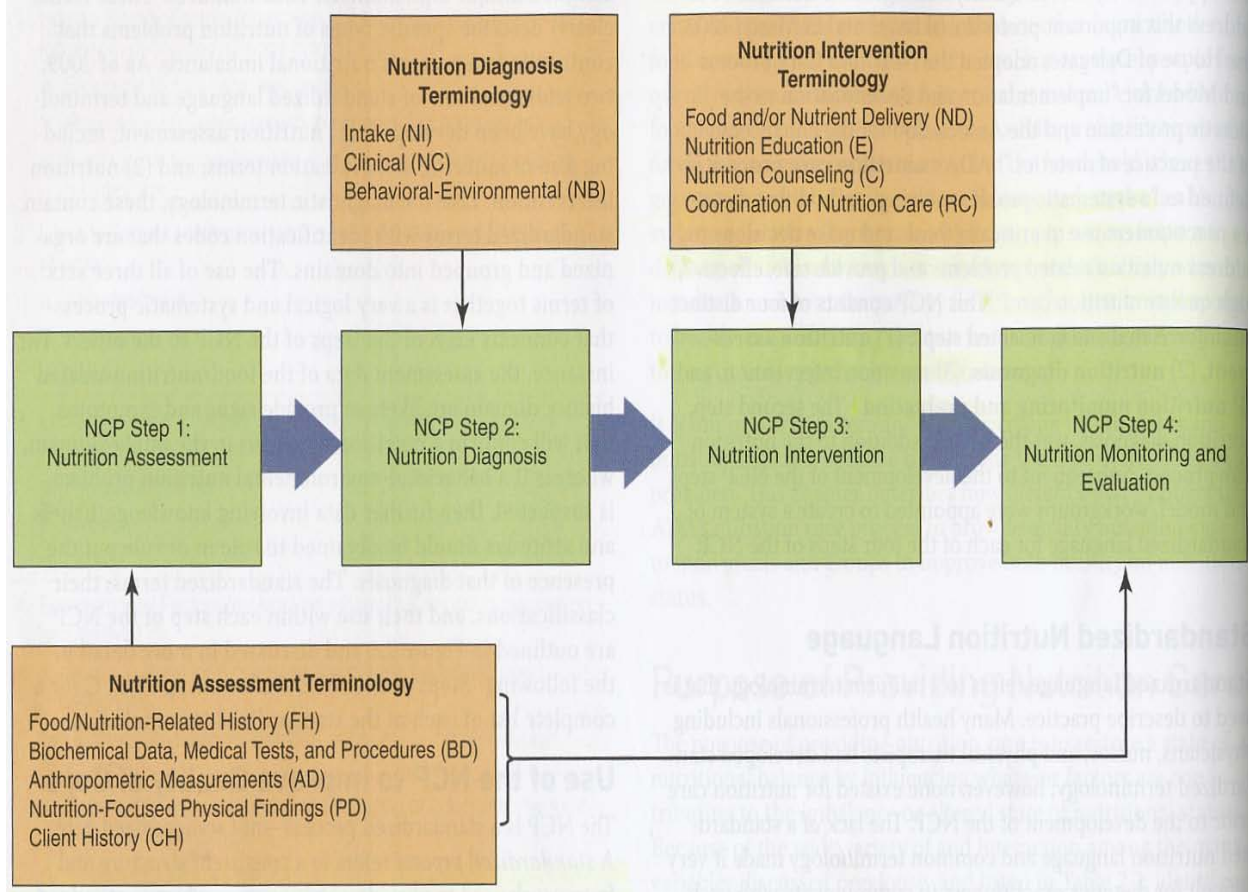


Table 2.3 Critical Thinking Used in the Nutrition Care Process

Nutrition Assessment

- Observe for nonverbal and verbal cues to prompt effective interviewing methods.
- Determine appropriate data to collect.
- Select assessment tools and procedures.
- Apply assessment tools in valid and reliable ways.
- Distinguish relevant from irrelevant data.
- Distinguish important from unimportant data.
- Validate the data.
- Organize and categorize the data in a meaningful framework that relates to nutrition problems.
- Determine when a problem requires consultation with or referral to another provider.

Nutrition Diagnosis

- Find patterns and relationships among the data and possible causes.
- Make inferences ("If this continues to occur, then this is likely to happen").
- State the problem clearly and singularly.
- Suspend judgment (be objective and factual).
- Make interdisciplinary connections.
- Rule in/rule out specific diagnoses.
- Prioritize the relative importance of problems.

Nutrition Intervention

- Set and prioritize goals.
- Define the nutrition prescription or basic plan.
- Make interdisciplinary connections.
- Initiate behavioral and other interventions.
- Match intervention strategies with client needs, diagnoses, and values.
- Choose from among alternatives to determine a course of action.
- Specify the time and frequency of care.

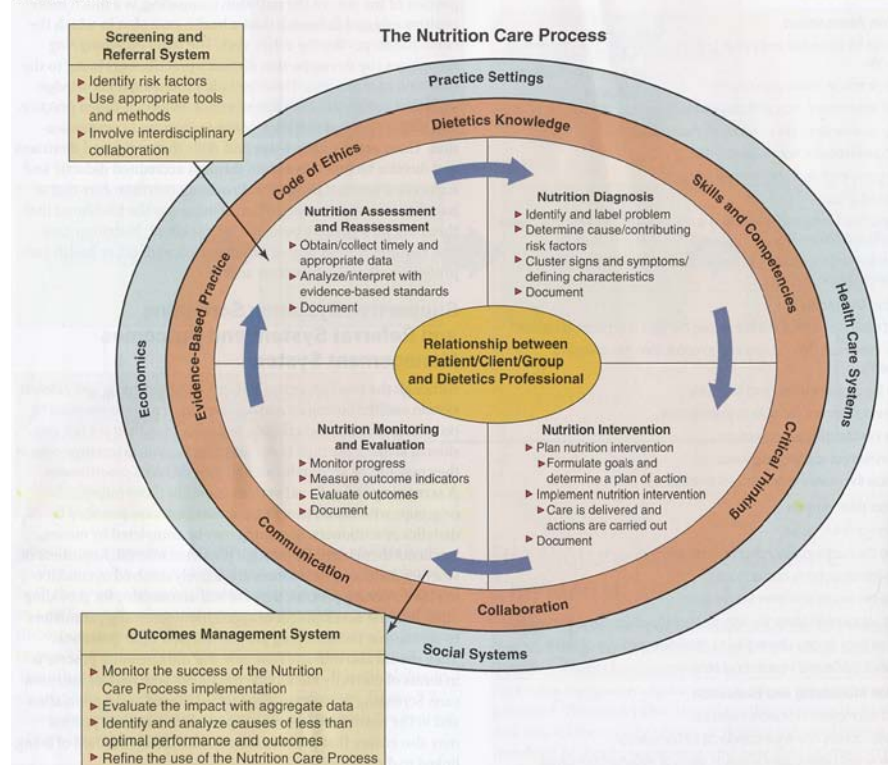
Nutrition Monitoring and Evaluation

- Select appropriate indicators/measures.
- Use appropriate reference standards for comparison.
- Define where patient/client is now in terms of expected outcomes.
- Explain variance from expected outcomes.
- Determine factors that help or hinder progress.
- Decide between discharge or continuation of nutrition care.

ADA's Standardized Nutrition Care Process

- The four steps of the nutrition care process are:
 - Nutrition assessment
 - Nutrition Diagnosis
 - Nutrition Intervention
 - Nutrition Monitoring and Evaluating
- By using the nutrition care process, dietetics practitioners can demonstrate that nutrition care improves outcomes because it:
 - Is a systematic method used to make decisions to provide safe and effective care
 - Provides a common language for documenting and communicating the impact of nutrition care
 - Relies on an evidence based approach
 - Uses specific critical thinking skills for each step

Figure 2.3 The Four Distinct but Interrelated and Connected Steps of the Nutrition Care Process and Model



Nutrition Care Process and Model

- Nutrition care is provided within the context of a larger model that includes a central core focused on individual care and positive relationships
- Both external (environmental) and internal (resources of dietetic practitioner) factors influenced the type of nutrition care provided
- Two other systems, the screening and the referral system and the outcomes management systems support the steps of the nutrition care process. Dietetics practitioner participates in both of these systems, but may not have sole responsibility for accomplishing the tasks they perform.

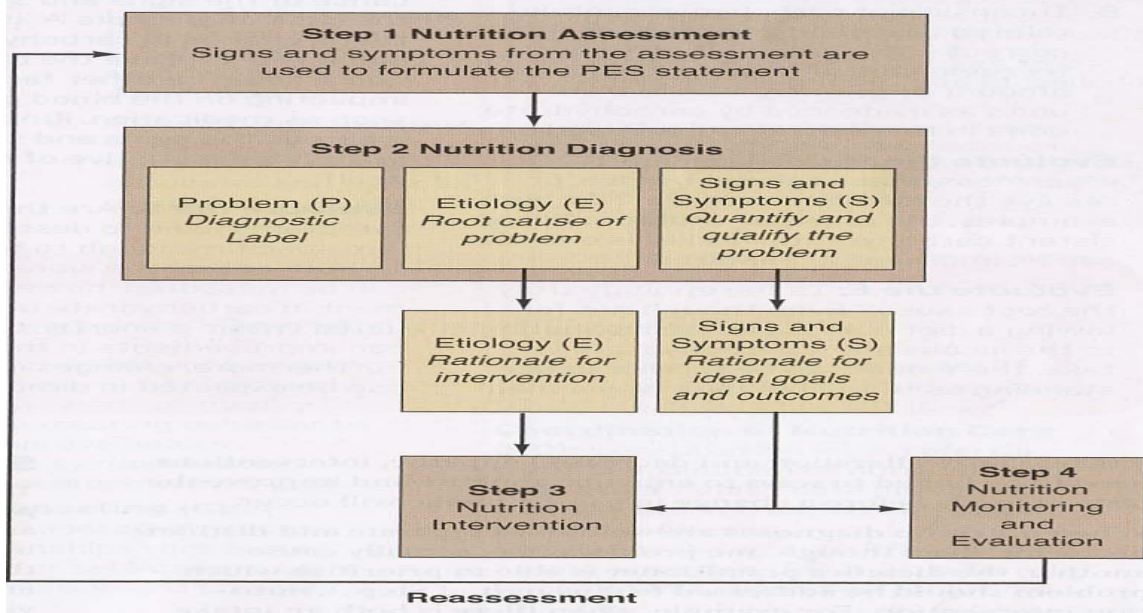
Nutrition Care Process Step 1 – Nutrition Assessment

- Nutrition care assessment should ensure that appropriate and reliable data that are collected for use in determining the existence of specific nutrition problems
- Organizing and categorizing data utilizing the five domains of the assessment standardized terms improves the efficiency and effectiveness of nutrition assessment and nutrition diagnosis

Nutrition Care Process Step 2 – Nutrition Diagnosis

- Nutrition diagnosis is not the same as a medical diagnosis. It describes a problem for which nutrition related activities provide the primary intervention.
- The desired format for writing a nutrition diagnosis is PES (problem, etiology, and signs and systems)
- Critical thinking skills such as finding patterns and relationships, stating problems clearly and singularly, and ruling in/ruling out certain diagnoses are essential to making accurate nutrition diagnosis
- Accurate nutrition diagnoses set the stage for quality nutrition intervention and nutrition monitoring and evaluating

Figure 2.4 Relationship of the Nutrition Diagnosis to the Other Steps of the NCP



Nutrition Care Process Step 3 – Nutrition Intervention

- First and foremost is the need to prioritize the nutrition diagnoses
- Ideal goals and expected outcomes need to be identified prior to implementing nutrition interventions
- Interventions are derived from accurate diagnoses and largely driven by client involvement
- ADA's evidence based guidelines for practice provides dietetics practitioners with tools that promote quality service and demonstrate effectiveness of care

Nutrition Care Process Step 4 – Nutrition Monitoring and Evaluating

- This step requires an active commitment to measuring and recording changes in the client's condition as they relate to the nutrition diagnosis signs and symptoms
- Progress should be monitored, measured, and evaluated on a planned schedule
- Direct nutrition outcomes, clinical and health status outcomes, patient/client-centered outcomes, and healthcare utilization outcome are the types of outcomes to be measured
- Data from this step can be used to create outcomes management systems and can contribute to the body of evidenced-based research

Documentation of the Nutrition Care Process

Purpose of Medical Record Charting

- Legal documentation of medical care that the client has received
- Communication between members of the health care team
- Evaluation of medical care for that client
- Funding and resource management
- Continuous quality improvement
- Third-party reimbursement
- Accreditation
- Research

“Do Not Use” List

Table 6.2 The Joint Commission Official “Do Not Use” List³

This list applies to all orders and all medication-related documentation that is handwritten (including free-text computer entry) or on preprinted forms.

Do Not Use	Potential Problem	Use Instead
U (unit)	Mistaken for “0” (zero), the number “4” (four) or “cc”	Write “unit”
IU (International Unit)	Mistaken for IV (intravenous) or the number 10 (ten)	Write “International Unit”
Q.D., QD, q.d., qd (daily)	Mistaken for each other	Write “daily”
Q.O.D., QOD, q.o.d., qod (every other day)	Period after the Q mistaken for “I” and the “O” mistaken for “I”	Write “every other day”
Trailing zero (X.0 mg)*	Decimal point is missed	Write X mg
Lack of leading zero (.X mg)		Write 0.X mg
MS	Can mean morphine sulfate or magnesium sulfate	Write “morphine sulfate”
MSO ₄ and MgSO ₄	Confused for one another	Write “magnesium sulfate”
Additional Abbreviations, Acronyms and Symbols (For possible future inclusion in the Official “Do Not Use” List)		
Do Not Use	Potential Problem	Use Instead
> (greater than)	Misinterpreted as the number “7” (seven) or the letter “L”	Write “greater than”
< (less than)	Confused for one another	Write “less than”
Abbreviations for drug names	Misinterpreted due to similar abbreviations for multiple drugs	Write drug names in full
Apothecary units	Unfamiliar to many practitioners Confused with metric units	Use metric units
@	Mistaken for the number “2” (two)	Write “at”
cc	Mistaken for U (units) when poorly written	Write “mL” or “ml” or “milliliters” (“mL” is preferred)
µg	Mistaken for mg (milligrams) resulting in one thousand-fold overdose	Write “mcg” or “micrograms”

SOAP

- Subjective Data
- Objective Data
- Assessment
- Plan

Table 6.3 Subjective Section of SOAP Note

Diet Related		
• Eating habits and feeding abilities • Use and fit of dentures • Appetite and digestion problems • Nausea, vomiting, constipation, diarrhea, heartburn, physical problems interfering with adequate oral intake	• Recent weight change • Diet history/previous diet modification or Rx • Usual pattern of food intake • Food allergies/aversions • Vitamin, mineral, and nutrient supplement intake	• Complementary/alternative nutrition therapy • Nutritional history and family nutritional history • Adequacy of prior dietary intake • Method of obtaining foods/nutrients (e.g., Meals on Wheels) • Previous nutrition education/counseling
Lifestyle/Psychosocial/Emotional		
• Economic situation/income • Ability to purchase/prepare/store food • Living or eating alone • Health promotion and exercise practices	• Exercise • Smoking • Interaction with/between other family members or caretakers	• Support systems • Coping mechanisms • Occupation
Medically Related		
• Personal and family medical history • Especially, diseases with nutritional implications (e.g., type 2 diabetes)	• Use of complementary/alternative medical therapies (CAM) • Medications, previous to admission or current PE	• Prescriptions, OTC (antacids, laxatives, etc.), and any CAM medications • Other physically related problems
Learning and Motivation Related		
• Ability to communicate in English (speaking, comprehending, reading, and writing) • Patient's comments about previous prescribed diets/medical treatment and compliance issues • Psychosocial problems, including addiction	• Desire to improve health or be involved in their own treatment or treatment decisions • Learning style/problem-solving abilities • Intellectual performance • Educational level	• Attention span • Long-term and recent memory • Readiness to learn • Barriers to change • Growth and maturation

Table 6.4 Objective Section of SOAP Note

- Age, ethnicity, gender, height/weight, BMI; any anthropometric measurement in addition to height and weight
- Biochemical lab results that are of nutritional relevance
- Clinical diagnosis, medication, treatment orders (including diet orders), any additional clinical findings of nutritional relevance
- Dietary information, including current intake that has been observed (not subjective) or analysis of diet quality; protein/kcalorie requirements

Table 6.5 Assessment Section of SOAP Note

1. Current nutrition **P**roblems, **E**tiology, and **S**igns/symptoms (PES)
2. Potential nutritional problems (due to prognosis or clinical course of the disease, noncompliance and/or drug nutrient interactions)
3. Prioritization of the nutrition diagnoses

Table 6.6 Plan Section of SOAP Note

Gather	Additional information you need or would like (for current and potential nutritional problems; for instance, whether the patient is lactose intolerant)
Referral	Referral to other health or social professional (examples: psychologist for an eating disorder or depression; social worker if patient is homeless)
Nutrition	Specific nutritional recommendations for the client/patient to address <i>current</i> nutritional problem(s) (these may be different than those stated under Assessment; for example, fewer kcalories to help achieve weight loss)
Goals/Education	1. What is/are your short-term goal(s) for this client/patient? 2. For each goal, state the expected outcome(s) of dietary compliance as behavioral objectives for change, or expected outcome of the nutrition support. (Remember that outcomes should be measurable; specify a time frame and criterion [by how much], and encourage client participation, if possible.) • Nutrition support to be recommended (when it is a medical procedure). • Visuals, models, printed material to be given or used, if appropriate. Example: (Goal) Patient will increase dietary fiber consumption. • Patient will eat whole-grain bread instead of white bread and increase consumption by one additional fruit and vegetable every day. • Patient will be given a handout on whole-grain products.
Evaluation	Timeline and measures for nutrition monitoring and evaluation (When and how will you evaluate the outcome of your nutrition plan goals?)

ADIME

- *Assessment, Diagnosis, Intervention, Monitoring/Evaluation (ADIME)*
- Reflects nutrition care process
- D sections is where PES statements are listed

IER

- Simplified SOAP
- *Intervention, Evaluation, Revision of Care*

TABLE 6.8

Sample IER Note

12/27/05 11:30 a.m. Nutrition Progress Note

Intervention:

Modify oral intake to 6-8 small feedings; increased nutrient density; addition of high-calorie, high-protein supplement; modification of texture; pain medication prior to meals and supplements.

Evaluation

Per calorie counts and patient visitation, oral intake improved, currently meeting 65% of estimated energy and protein requirements. No further weight loss documented since admission.

Revision

Check prealbumin to monitor visceral protein status.

FOCUS NOTES

- Blending SOAP and IER notes

TABLE 6.9

Sample Focus Note

12/27/05 Nutrition Progress Note

Time	Focus	Data
11:30 a.m.	Inadequate oral intake	Data: 22 lb. weight loss over previous 3 months. Albumin 3.0; 24-hour recall indicates <25% of kcal and protein requirements met Action: 6–8 small feedings; increased nutrient density; addition of high-calorie, high-protein supplement; modification of texture. Response: Caloric intake has increased by 45%. No further weight loss documented.
	Swallowing difficulty	Data: Mucositis; dehydration and inadequate caloric intake Action: Pain medication prior to meals and supplements; modification of texture of meals and food choices to minimize pain. Response: Mucositis resolving; Oral intake improved.

Signature:

M. Nahikian-Nelms, Ph.D.,–R.D.,–L.D.

PIE

- *Problem intervention evaluation*

TABLE 6.10

Sample PIE Note

12/27/05 11:30 a.m. Nutrition Progress Note

Problem

Involuntary weight loss

Intervention

Modify oral intake to 6–8 small feedings; increased nutrient density; addition of high-calorie, high-protein supplement; modification of texture; pain medication prior to meals and supplements.

Evaluation

Per calorie counts and patient visitation, oral intake improved currently, meeting 65% of estimated energy and protein requirements. No further weight loss documented since admission.

Signature:

M. Nahikian-Nelms, PhD, –RD, –LD

Calculations to Use

Anthropometrics

Measurement of body size frequently used to gain a general idea of nutritional status

Used to identify those people whose growth is outside normal values suggesting under or over nutrition

Screening tool to identify individuals at high risk of malnutrition

Use to monitor effects of nutritional intervention for treatment of disease, surgery, or malnutrition

Frame Size

Wrist circumference: measure wrist in cm

Calculate **r = Ht (cm) / circumference (cm)**

	Small	Medium	Large
Men	>10.4	10.4-9.6	<9.6
Women	>11	10.1-11.0	<10.1

Midarm Circumference (MAC)

Measure arm in cm three times. Record the average and convert to mm (cm x 10 = mm)

Triceps Skin Fold (TSF)

Measure fold in mm three times. Record the average

Subscapular Skin Fold (SSF)

Measure fold in mm three times. Record the average

Midarm Muscle Area (MAMA)

Use MAC and TSF to calculate

$$[[\text{MAC in mm} - (3.14 \times \text{TSF in mm})]^2 / 12.56 = \text{MAMA in mm}^2]$$

Divide MAMA by 100 to convert mm² to cm²

Subtract adjust factor (10 cm² male; 6.5 cm² female)

Determine MAMA Percentile

Waist Circumference

Measure at the natural waistline, which is normally, the narrowest part of the trunk and above the umbilicus. Measure with the tape snug but not tight.

Low risk	Men <90 cm	Women <80 cm
High risk	Men >102 cm	Women >88 cm

Waist to Hip Ratio Risk Categories

Risk Level	Men	Women	Goal
High	>1.0	>0.85	Lose Fat Mass
Moderate	0.95 – 1	0.8-0.85	Lose Fat Mass
Low	<0.95	<0.80	Maintain

Height/Weight

Measure client in stocking feet and minimal clothing

Record both in U.S. and metric measures

Inch x 2.54 = cm cm/100 = M pound/2.2 = kg

Weight Percentile

Determine Wt. percentile using chart (15-50% considered average)

IBW

Hamwi Formula

Men: 106# for the first 5ft and an additional 6# for each inch >60"

Women: 100# for the first 5ft and an additional 5# for each inch >60"

Adjust for frame size if: small (subtract 10%) or large (add 10%)

IBW %

Current wt / IBW x 100

UBW %

Current wt / usual body wt x 100

Body Mass Index

Weight (kg) / Height² (m)

Weight (lb) / Height² (in) x 704.5

Normal Ranges of Percent Fat

Age	0-30	31-40	41-50	51-60	61-
Male	12% - 18%	13% - 19%	14% - 20%	16% - 20%	17% - 21%
Females	20% - 26%	21% - 27%	22% - 28%	22% - 30%	22% - 31%

BIA – Bioelectrical Impedance Analysis

Body composition analysis technique based on the principle that lean tissue has a higher electrical conductivity and lower impedance (i.e. resistance) than fatty tissue

Impedance – measure of how current is slowed as it travels through the body

Resistance – measure of the amount of electrical current that will stop (95%)

Reactance – measure of a material's ability to slow a current (5%)

Normal Ranges of Total Body Water

	Normal Ranges
Males	55% - 65%
Females	50% - 60%
Obese	45% - 50%
Highly Muscled	70% - 80%

Table 3.12 Estimation of Energy Requirements**Harris-Benedict Equation**

REE for females = $655.1 + 9.6 W + 1.9 H - 4.7 A$

REE for males = $66.5 + 13.8 W + 5.0 H - 6.8 A$

[W = weight in kg; H = height in cm; A = age in years]

Mifflin-St. Jeor Equation

REE for females: $10 W + 6.25 H - 5 \text{ Age} - 161$

REE for males: $10 W + 6.25 H - 5 \text{ Age} + 5$

[W = weight in kg; H = height in cm; A = age in years]

American College of Chest Physicians Equation

REE = $25 \times \text{weight (kg)}$

[If BMI = 16–25, use usual body weight; If BMI >25, use ideal body weight; and if BMI <16, use existing body weight for first 7–10 days, then use ideal body weight.]

Penn State 2003 Equation

REE = $(0.85 \times \text{value from Harris-Benedict equation}) + (175 \times T_{\max}) + (33 \times V_e) - 6443$

[V_e = minute volume (in L/min); $T_{\max}$ = maximum body temp in previous 24 hours]

Ireton-Jones 1997 Equation

REE = $(5 \times \text{weight}) - (11 \times \text{age}) + (244 \text{ if male}) + (239 \text{ if trauma present}) + (840 \text{ if burns present}) + 1784$

[W = weight in kg; H = height in cm; A = age in years]

Swinamer 1990 Equation

REE = $(945 \times \text{body surface area}) - (6.4 \times \text{age}) + (108 \times \text{temperature}) + (24.2 \times \text{respiratory rate}) + (817 \times V_T) - 4349$

[V_T = tidal volume in liters]

FAO/WHO Basal Energy Estimation Equations

	Age	Equation*
Men	18–30 years	Kcal/day = $(15.3 \times \text{weight}) + 679$
	30–60 years	Kcal/day = $(11.6 \times \text{weight}) + 879$
	>60 years	Kcal/day = $(8.8 \times \text{weight}) + (1128 \times \text{height}) - 1071$
Women	18–30 years	Kcal/day = $(14.7 \times \text{weight}) + 496$
	30–60 years	Kcal/day = $(8.7 \times \text{weight}) + 829$
	>60 years	Kcal/day = $(9.2 \times \text{weight}) + (637 \times \text{height}) - 302$

*Height in m; weight in kg

Figure 3.4 Example of a Food Frequency: MEDFICTS

In each food category for both Group 1 and Group 2 foods check one box from the "Weekly Consumption" column (number of servings eaten per week) and then check one box from the "Serving Size" column. If you check Rarely/Never, do not check a serving size box. See next page for score.

Food Category	Weekly Consumption			Serving Size			Score
	Rarely/ never	3 or less	4 or more	Small <5 oz/d 1 pt	Average 5 oz/d 2 pts	Large >5 oz/d 3 pts	
Meats							
- Recommended amount per day: 5 oz (equal in size to 2 decks of playing cards). - Base your estimate on the food you consume most often. - Beef and lamb selections are trimmed to 1/8" fat. Group 1. 10 g or more total fat in 3 oz cooked portion Beef—Ground beef, Ribs, Steak (T-bone, Flank, Porterhouse, Tenderloin), Chuck blade roast, Brisket, Meatloaf (w/ground beef), Corned beef Processed meats—1/4 lb burger or lg. sandwich, Bacon, Lunch meat, Sausage/knockwurst, Hot dogs, Ham (bone-end), Ground turkey Other meats, Poultry, Seafood—Pork chops (center loin), Pork roast (Blade, Boston, Sirloin), Pork spareribs, Ground pork, Lamb chops, Lamb (ribs), Organ meats†, Chicken w/skin, Eel, Mackerel, Pompano Group 2. Less than 10 g total fat in 3 oz cooked portion Lean beef—Round steak (Eye of round, Top round), Sirloin†, Tip & bottom round†, Chuck arm pot roast†, Top Loin† Low-fat processed meats—Low-fat lunch meat, Canadian bacon, "Lean" fast food sandwich, Boneless ham Other meats, Poultry, Seafood—Chicken, Turkey (w/o skin)§, most Seafood†, Lamb leg shank, Pork tenderloin, Sirloin top loin, Veal outlets, Sirloin, Shoulder, Ground veal, Venison, Veal chops and ribs†, Lamb (whole leg, fore-shank, sirloin)†	☐	☐ 3 pts	☐ 7 pts	☒ 1 pt	☐ 2 pts	☐ 3 pts	_____
	☐	☐	☐	☒	☐	☐ 6 pts	_____
Eggs – Weekly consumption is the number of times you eat eggs each week Check the number of eggs eaten each time							
Group 1. Whole eggs, Yolks	☐	☐ 3 pts	☐ 7 pts	☒ 1 pt	☐ 2 pts	☐ ≥3 3 pts	_____
Group 2. Egg whites, Egg substitutes (1/2 cups)	☐	☐	☐	☐	☐	☐	_____
Dairy							
Milk—Average serving 1 cup Group 1. Whole milk, 2% milk, 2% buttermilk, Yogurt (whole milk) Group 2. Fat-free milk, 1% milk, Fat-free buttermilk, Yogurt (Fat-free, 1% low fat) Cheese—Average serving 1 oz Group 1. Cream cheese, Cheddar, Monterey Jack, Colby, Swiss, American processed, Blue cheese, Regular cottage cheese (1/2 cup), and Ricotta (1/4 cup) Group 2. Low-fat & fat-free cheeses, Fat-free milk mozzarella, String cheese, Low-fat, Fat-free milk & Fat-free cottage cheese (1/2 cup) and Ricotta (1/4 cup) Frozen Desserts—Average serving 1/2 cup Group 1. Ice cream, Milk shakes Group 2. Low-fat ice cream, Frozen yogurt	☐	☐ 3 pts	☐ 7 pts	☒ 1 pt	☐ 2 pts	☐ 3 pts	_____
	☐	☐	☐	☐	☐	☐	_____
	☐	☐ 3 pts	☐ 7 pts	☒ 1 pt	☐ 2 pts	☐ 3 pts	_____
	☐	☐	☐	☐	☐	☐	_____

Figure 3.4 Example of a Food Frequency: MEDFICTS (*Continued*)

Food Category	Weekly Consumption			Serving Size			Score						
	Rarely/ never	3 or less	4 or more	Small <5 oz/d 1 pt	Average 5 oz/d 2 pts	Large >5 oz/d 3 pts							
Frying Foods – Average servings: see below. This section refers to method of preparation for vegetables and meat.													
Group 1. French fries, Fried vegetables (1/2 cup), Fried chicken, fish, meat (3 oz)	☐	☐ 3 pts	☐ 7 pts	☐ 1 pt	☐ 2 pts	☐ 3 pts	_____						
Group 2. Vegetables, not deep fried (1/2 cup), Meat, poultry, or fish—prepared by baking, broiling, grilling, poaching, roasting, stewing: (3 oz)	☐	☐	☐	☐	☐	☐	_____						
Baked Goods – 1 Average serving													
Group 1. Doughnuts, Biscuits, Butter rolls, Muffins, Croissants, Sweet rolls, Danish, Cakes, Pies, Coffee cakes, Cookies	☐	☐ 3 pts	☐ 7 pts	☐ 1 pt	☐ 2 pts	☐ 3 pts	_____						
Group 2. Fruit bars, Low-fat cookies/cakes/pastries, Angel food cake, Homemade baked goods with vegetable oils, breads, bagels	☐	☐	☐	☐	☐	☐	_____						
Convenience Foods													
Group 1. Canned, Packaged, or Frozen dinners: e.g., Pizza (1 slice), Macaroni & cheese (1 cup), Pot pie (1), Cream soups (1 cup), Potato, rice & pasta dishes with cream/cheese sauces (1/2 cup)	☐	☐ 3 pts	☐ 7 pts	☐ 1 pt	☐ 2 pts	☐ 3 pts	_____						
Group 2. Diet/Reduced calorie or reduced fat dinners (1), Potato, rice & pasta dishes without cream/cheese sauces (1/2 cup)	☐	☐	☐	☐	☐	☐	_____						
Table Fats—Average serving: 1 Tbsp Group 1. Butter, Stick margarine, Regular salad dressing, Mayonnaise, Sour cream (2 Tbsp)	☐	☐ 3 pts	☐ 7 pts	☐ 1 pt	☐ 2 pts	☐ 3 pts	_____						
Group 2. Diet and tub margarine, Low-fat & fat-free salad dressing, Low-fat & fat-free mayonnaise	☐	☐	☐	☐	☐	☐	_____						
Snacks													
Group 1. Chips (potato, corn, taco), Cheese puffs, Snack mix, Nuts (1 oz), Regular crackers (1/2 oz), Candy (milk chocolate, caramel, coconut) (about 1 1/2 oz), Regular popcorn (3 cups)	☐	☐ 3 pts	☐ 7 pts	☐ 1 pt	☐ 2 pts	☐ 3 pts	_____						
Group 2. Pretzels, Fat-free chips (1 oz), Low-fat crackers (1/2 oz), Fruit, Fruit rolls, Licorice, Hard candy (1 med piece), Bread sticks (1–2 pcs), Air-popped or low-fat popcorn (3 cups)	☐	☐	☐	☐	☐	☐	_____						
† Organ meats, shrimp, abalone, and squid are low in fat, but high in cholesterol. ‡ Only lean cuts with all visible fat trimmed. If not trimmed of all visible fat, score as if in Group 1. ¥ Score 6 pts if this box is checked. § All parts not listed in Group 1 have <10 g total fat.							Total from page 1 _____ Total from page 2 _____ Final Score _____						
To Score: For each food category, multiply points in weekly consumption box by points in serving size box and record total in score column. If Group 2 foods checked, no points are scored (except for Group 2 meats, large serving = 6 pts).													
Example: <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>☐</td> <td>☐ 3 pts</td> <td>☒ 7 pts</td> <td>☐ 1 pt</td> <td>☐ 2 pts</td> <td>☒ 3 pts</td> </tr> </table> 21 pts								☐	☐ 3 pts	☒ 7 pts	☐ 1 pt	☐ 2 pts	☒ 3 pts
☐	☐ 3 pts	☒ 7 pts	☐ 1 pt	☐ 2 pts	☒ 3 pts								
Add score on page 1 and page 2 to get final score.													
Key: ≥70 Need to make some dietary changes 40–70 Heart-Healthy Diet <40 TLC Diet													

Figure 3.1 Malnutrition Universal Screening Tool

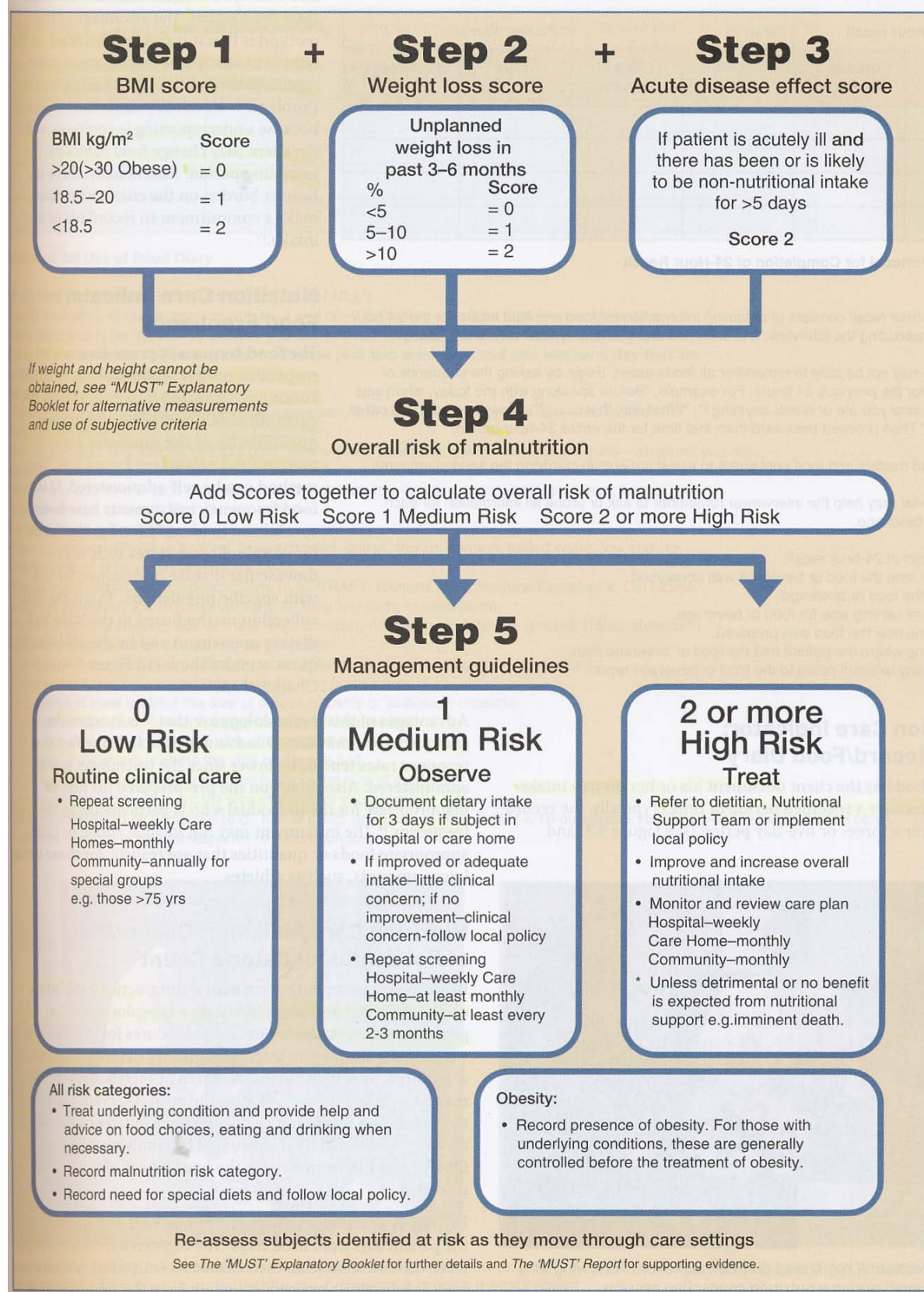


Table 3.9

Serum Protein	Normal Range	Half-Life	Primary Function	Comments
Albumin	3.5–5.0 g/dL	17–21 days	Blood transport protein; component of vascular fluid and electrolyte balance	Trauma, surgery, and metabolic stress affect levels; affected by hydration status—decreases with overhydration, increases with dehydration
Transferrin	215–380 mg/dL	8–10 days	Iron transport	Negative acute-phase respondent; affected by iron status
Prealbumin/ transthyretin	19–43 mg/dL	2–3 days	Transport of thyroxine	Negative acute-phase protein—decreases with illness, infection, trauma, surgery, and metabolic stress; decreases with diagnoses of liver disease such as hepatitis or cirrhosis, malabsorption, and hyperthyroidism
Retinol binding protein	2.1–6.4 mg/dL	10–12 hours	Transport molecule for vitamin A	Negative acute-phase respondent; elevated with renal failure; decreased with hyperthyroidism, cystic fibrosis, liver failure, vitamin A deficiency, zinc deficiency, and metabolic stress
Fibronectin	220–400 mg/dL	15 hours	Wound healing and vascular integrity; cell and differentiation	Affected by coagulation, inflammation, and injury process

Fluid and Electrolyte Balance

Calculating Fluid Requirements

Method 1	Based on energy intake – 1mL of fluid per kcal
Method 2	Based on body weight
AGE/GENDER	mL/kg
1-10 kg	100-150
11 – 20 kg	Add 50 mL/kg over 10kg
≥21 kg	Add 25 mL/kg over 20 kg
Young adult 16 – 31 yrs	40-60
Average Adult	30-35
Adult 55-65 yrs	30
Adult > 65 yrs	25
Method 3	Based on nitrogen and energy intake – 1mL/kcal + 100mL/g N
Method 4	Based on body surface area – 1500mL/M ²

Table 7.3 Adequate Intakes (AI) for Sodium, Chloride, and Potassium

Age (yr)	Sodium AI (mg/day)	Chloride AI (mg/day)	Potassium AI (mg/day)
<i>Infants</i>			
0–0.5	120	180	400
0.5–1	370	570	700
<i>Children</i>			
1–3	1000	1500	3000
4–8	1200	1900	3800
<i>Adults</i>			
9–13	1500	2300	4500
14–50	1500	2300	4700
51–70	1300	2000	4700
> 70	1200	1800	4700
<i>Pregnancy</i>	1500	2300	4700
<i>Lactation</i>	1500	2300	5100

Table 7.4 Normal Serum Values for Sodium, Potassium, and Chloride

Electrolyte	Normal Serum Level
Sodium	136 to 146 mEq/L
Potassium	3.5 to 5.0 mEq/L
Chloride	98–106 mEq/L

Table 7.5 Clinical Changes in Fluid and Electrolyte Disorders

Assessment	Evaluation
Daily weights: 2% ↑↓: mild fluid volume deficit or excess 5% ↑↓: moderate deficit or excess 8% ↑↓: severe deficit or excess	Rapid changes reflect fluid changes Body weight does not change when fluid shifts to third spaces
Eyes: dry conjunctiva, decreased tearing	Fluid volume deficit
Periorbital edema	Fluid volume excess
Lips and oral cavity: dry, cracked lips; small multifurrowed tongue	Fluid volume deficit
Decreased skin turgor	Fluid volume deficit
Tachycardia	Fluid volume deficit
Slowed pulse, increased BP	Fluid volume excess
Orthostatic BP	Fluid volume deficit
Hand veins	Prolonged filling: volume deficit Prolonged emptying: volume excess
Central venous pressure (CVP)	↓ CVP: volume deficit ↑ CVP: volume excess
Jugular vein distention (JVD)	Flat neck veins when supine: volume deficit Extended JVD: volume excess
Cardiac dysrhythmias	May indicate deficit or excess of K, Mg, Ca, PO ₄
Lungs: pulmonary congestion; ↑ respiratory rate, moist rales, rhonchi	Fluid volume excess
Oliguria	Severe fluid volume deficit
Extremities; localized swelling; sacrum: edema present	Fluid volume excess

Table 7.6 Biochemical Evaluation of Fluid and Electrolyte Status

Blood Tests	Normal Value	Discussion: Additional Factors That May Affect Levels
Potassium	3.5 to 5.0 mEq/L	↑ in acidosis ↓ in alkalosis
Sodium	135 to 145 mEq/L	Consistent with current osmolality. ↓ Na = hyperosmolar body fluids. Rare that it would indicate high Na levels. ↑ Na = dilutional body fluids in relationship to solute.
Chloride	98 to 106 mEq/L	↑ Cl may indicate metabolic acidosis. ↓ Cl often with metabolic alkalosis and hypokalemia.
Calcium	8.7 to 9.2 mg/dL	Evaluate with serum albumin levels—total Ca ↓ when albumin is low, but ionized calcium does not change.
Phosphate	2.5 to 4.5 mg/dL	Elevated in chronic renal failure.
Hematocrit	37% to 47% (women) 40% to 54% (men)	↑ in fluid volume deficit ↓ in fluid volume excess
Glucose	70 to 110 mg/dL	Hyperglycemia causes osmotic diuresis and ↓ blood volume.
BUN	8 to 26 mg/dL	↑ in fluid volume deficit ↓ in fluid volume excess
Osmolality	275 to 295 mOsm/kg	↑ in fluid volume deficit ↓ in fluid volume excess

Table 7.7 Evaluation of Fluid and Electrolyte Status: Urine Tests

Urine Tests	Normal Value	Comments
Sodium	100 to 260 mEq/24 hr >40 mEq/L in random sample	<10 mEq/24 hr = hyponatremia/edema/volume depletion
Potassium	25 to 100 mEq/24 hr	↑ hyperaldosteronism ↓ adrenal insufficiency
Chloride	110 to 250 mEq/24 hr	<10 mEq/L in metabolic alkalosis secondary to volume deficit >20 mEq/L in metabolic alkalosis caused by hyperaldosteronism or ↓ K ⁺
Color	Pale yellow	Dark, amber, hazy in dehydration/fluid deficit
Urine osmolality	50 to 1400 mOsm	Reflects concentrating or diluting ability
Specific gravity	1.003 to 1.030	↑ in fluid deficit/dehydration and hyperosmolar urine

Table 7.8 Commonly Prescribed Intravenous Solutions

Intravenous Solutions	Content	Osmolality mOsm/L	Use
5% Dextrose 10% Dextrose	No electrolytes—5 g dextrose/dL; 170 kcal/L No electrolytes—10 g dextrose/dL; 340 kcal/L	252 505	Free water; correction of fluid balance and hypernatremia; provides some energy
0.45% Saline ("Half Normal Saline")	77 mEq Na ⁺ /L, 77 mEq Cl ⁻ /L	154	No energy provided; correction of fluid balance but doesn't necessarily correct electrolyte imbalances
0.9% Saline ("Normal Saline")	154 mEq Na ⁺ /L, 154 mEq Cl ⁻ /L	308	Na ⁺ and Cl ⁻ are greater than in plasma levels; can be administered with blood products
Ringer's Solution	130 mEq Na ⁺ , 4 mEq K ⁺ , 2 mEq Ca ²⁺ , 109 mEq Cl ⁻	309	Similar to plasma composition; does not provide free water or energy
Lactated Ringer's (Hartmann's Solution)	130 mEq Na ⁺ , 4 mEq K ⁺ , 2 mEq Ca ²⁺ , 109 mEq Cl ⁻ , 29 g lactate	273	Similar to plasma composition; does not provide free water or energy
Dextrose in Saline: 5% in 0.225%	170 kcal/L, 38.5 mEq Na ⁺ /L, 38.5 mEq Cl ⁻ /L	355	Provides energy, free water, sodium, and chloride
Dextrose in Saline: 5% in 0.455%	170 kcal/L, 77 mEq Na ⁺ /L, 77 mEq Cl ⁻ /L	406	
Dextrose in Saline: 5% in 0.9%	340 kcal/L, 154 mEq Na ⁺ /L, 154 mEq Cl ⁻ /L	560	

ENTERAL NUTRITION

- Provision of nutrients into the GI tract through tube or catheter when oral intake is inadequate.
- Considered when patient cannot or will not eat has a functional GI tract, and safe access.
- If the gut works, use it!
- Conditions that often require enteral nutrition:
 - Impaired nutrient ingestion
 - Inability to consume adequate nutrition orally
 - Impaired digestion, absorption. Metabolism
 - Severe wasting or depressed growth

Access

- Nasogastric route:
 - Short term (up to 3 or 4 weeks)
 - Non-surgical
 - Normal GI function
 - Bolus, intermittent or continuous infusions
- Nasoduodenal or nasojejunal route:
 - Short term (up to 3 or 4 weeks)
 - Non-surgical
 - Used with gastric motility disorders, aspiration, or persistent nausea and vomiting, gastric ileus
- Surgically placed OSTOMY:
 - Gastrostomies or jejunostomies
 - Long-term (> 4 weeks)
- Percutaneous endoscopic gastrostomy (PEG) or percutaneous jejunostomy (PEJ):
 - Longer than 3 to 4 weeks
 - Non-surgical
- Multiple lumen tubes:
 - Long term (> 4 weeks)
 - Used with prolonged GI decompression and small bowel feeding

Administration

- Continuous drip:
 - Infusion via pump/gravity
 - Used in small intestine feedings
 - Used to prevent GI stress
 - Minimizes risk of aspiration
 - Hourly rate determined by dividing the total volume of formula by the total number of feedings hours desired
- Bolus
 - Up to 250-500 mL rapid delivery via syringe 3 or 4 times daily (15 minutes)
 - No pump
 - Gastric feedings only
 - Total volume of formula is divided into number of feedings desired
- Intermittent:
 - Start with 100 to 150 mL and increase as tolerated, 20 to 60 minutes, several times per day via gravity drip or syringe

Formula

- Selection is based on:
 - Functional status of GI tract
 - Physical characteristics of formula
 - Energy and nutrient content
 - Digestion and absorption capability of patient
 - Clinical considerations
 - Cost effectiveness
 - Categories of formula:
 - Polymeric (whole protein and CHO)
 - Fiber containing (polymeric with fiber)
 - Monomeric (predigested nutrients, most low fat content, patients with minimal digestive and absorptive capacities)
 - Disease specific (e.g. respiratory, diabetes, renal failure, hepatic failure)

- Composition of formula:
 - Standard (lactose-free, concentrated)
 - High-nitrogen (increased protein requirements i.e. burns, fistulas, trauma, sepsis)
 - Protein (intact vs. hydrolyzed vs. pure amino acids; must provide 14 – 16% of calories)
 - Carbohydrate (30 – 90% of kcals; lactose not used; addition of fiber)
 - Lipid (1.5 – 55% of kcals, 2 – 4% as linoleic acid; fat does not influence osmolality, requires less CO₂ production)
 - Designer formulas (MCT for fat malabsorption; formulas with added n-3 fatty acids; structured lipids)
 - Vitamins, minerals and electrolytes (based on DRI's; expressed as mL to meet 100% DV's on label)
 - Fluid (1 mL/kcal standard; 60 – 85% water; can provide additional water via tube as needed)
 - Modular formulas (single nutrient component; most common is protein)
- Osmolality is a measure of which active particles per kg of solvent in which the particles are dispersed. Osmolality affects gastric retention, abdominal distention, diarrhea, nausea, and vomiting.
 - Normal osmolality is 280-294 mOsm/kg
 - Hypertonic: > this
 - Hypotonic: < this
 - Isotonic: Approx. 300 and up to 500 mOsm/kg

Example of Enteral Formula Calculation

- Pt calorie needs = 1500 kcal/day
- Protein needs: 58 g/day
- Fluid needs: Approx 1800 mL
- Formula: Novartis 1.07 kcal/mL, 43 g pro/L, 85% water

$1500 \text{ kcal per day} / 1.07 \text{ kcal per mL} = 1402 \text{ mL} / 24 \text{ hours} = 58 \text{ mL/hr} \times 24 = 1392 \text{ mL per day}$
(1.392 L per day)

$1392 \text{ mL} \times 1.07 \text{ kcal per mL} = 1498 \text{ total kcal}$

Protein = $1.392 \text{ L} \times 43 \text{ g pro per L} = 60 \text{ g protein per day}$

Fluids = $1392 \text{ mL} \times 0.85 \text{ water} = 1183 \text{ mL water}$

$1800 \text{ mL fluid needed} - 1183 \text{ mL fluid used} = 617 \text{ mL water wash} = 205 \text{ mL every 8 hours (3}$
ww/d)

PARENTERAL NUTRITION

- Provision of nutrients directly into bloodstream intravenously
- Considered when feeding by an enteral route is not feasible or when the patient is hypermetabolic and it is not physically possible to meet total nutritional needs via enteral nutrition support
- If the gut works, use it!
- Conditions that often require parenteral nutrition:
 - Peritonitis
 - Short bowel syndrome
 - Uncontrollable diarrhea
 - Paralytic ileus
 - Chronic pancreatitis

Access

- Central parenteral nutrition (CPN):
 - Also known as total parenteral nutrition (TPN)
 - Catheter in large, central high blood-flow vein such as superior vena
 - Short term access: Peripherally inserted central catheters (PICC)
 - Long term access: tunneled catheters
 - Often provides total nutritional support
 - Can meet total nutritional requirements
 - Can provide 4000 kcal/day
 - Hypertonic solution
 - Starts out slow and is gradually increased to desired rate
- Peripheral Parenteral Nutrition (PPN):
 - Catheter in small vein, typically arm
 - Short term only (5-7 days or < 6 weeks)
 - Cannot tolerate concentrated solutions
 - Usually adjunct nutritional therapy (supplement to oral or enteral feedings)
 - Cannot meet total nutritional requirements
 - Can provide 1800 kcal/day

- o Isotonic or slightly hypertonic solution ($< 900 \text{ mOsm/kg}$)

Administration of TPN

- Initiate 1 L first day; increase to goal volume on day 2
- Usually initiated at slow rate of 25 to 50 mL per hour
- Advanced every 12 or 24 hours
- Continuous:
 - o Starting point for everyone
 - o Increase incrementally over 2 or 3 days to reach goal rate
 - o Avoid abrupt cessation
- Cyclic:
 - o 8 to 12 hours per day, usually at night
 - o Higher rate or more concentrated solution

Components of TPN

- Carbohydrate:
 - o Dextrose monohydrate
 - o Calories per gram = 3.4
 - o Availability: 5, 10, 20, 25, 30, 40, 50 and up to 70%
 - o Liver's maximum rate of oxidation is 5 mg/kg/minute

Examples:

25% dextrose solution (D25) = 25 g dextrose/100 mL

800 mL of D30 has 240 g CHO and 816 kcals

$(800 \times .30 = 240 \text{ g CHO}; 240 \text{ g} \times 3.4 = 816 \text{ kcals})$

Glucose rate of oxidation for a 70 kg male getting 200 g dextrose = 1.98 mg/kg/min

$(200 \text{ g} = 200,000 \text{ mg}; 200,000 \text{ mg}/70 \text{ kg} = 2857.143/24 \text{ hrs a day} = 119/60 \text{ min in an hr} = 1.98 \text{ mg/kg/min})$

- Amino acids:
 - o Crystalline amino acids with or without electrolytes
 - o 4 kcal/gram
 - o Standard solutions: 3.5, 5.5, 8.5, 10, 15%

Examples:

3.5% AA = 3.5/100 mL or 35 g/100 mL

300 mL of AA10 has 30 g protein, 120 kcals, and 4.8 g nitrogen

(300 x .10 = 30 g protein; 30 g pro x 4 = 120 kcals; 30 g pro x .16 = 4.8 g nitrogen)

- Lipids:
 - Fat emulsions (composed of safflower oil, soybean oil, or a combo)
 - Major source of calories (4% should be linoleic acid)
 - Isotonic solutions
 - 10% = 1.1 kcal/min
 - 20% = 2.0 kcal/min
 - 30% 3.0 kcal/mL
 - Do not exceed 2.5 g/kg/day or 60% of nonprotein calories in adults

Examples:

500 mL of 10% lipids = 550 kcals (500 x 1.1 = 550)

250 mL of 20% lipids = 500 kcals (250 x 2.0 = 500)

- Vitamins/minerals:
 - Recommendations lower than RDA because digestion and absorption bypassed
 - Choice of salt forms for electrolytes: chloride (acidic) or acetate (basic)

Components of PPN

- Crystalline amino acids:
 - Don't exceed 3-5% at final concentration
- Dextrose:
 - Don't exceed 5 – 10% at final concentration
- Electrolytes/Vitamins/Minerals:
 - Based on intake from other sources (oral, tube, IV)
- Fat emulsions:
 - Based on kcal requirement
 - Don't exceed 2.5 g fat per kg body weight per day

Transitional Feeding

- Parenteral to enteral:
 - Takes 2-3 days
 - Stop parenteral when enteral reaches 75%
- Parenteral to oral:
 - Stop parenteral when oral reaches 75%
- Enteral to oral:
 - Reduce enteral to night only to reestablish hunger/satiety cues

GI SYSTEMS

- Upper: Mouth, pharynx, esophagus, stomach
- Lower: Small and large intestine (includes ascending, transverse, descending, and sigmoid colon)
- Accessory organs: Liver, Biliary system, pancreas

Needed for

- Motility
 - o Oral cavity, esophagus, stomach, intestines
- Secretion:
 - o Gastric secretions of the stomach (gastric juice, mucous cells, chief cells, parietal cells, ECL cells), small intestine secretions (digestive enzymes, bicarbonate, bile)
- Digestion
 - o Digestion in the stomach is mechanical and chemical; also occurs in large and small intestine
- Absorption:
 - o Absorption occurs mostly in the small and absorption of water and some minerals in the large intestine

Pathophysiology of the Upper GI Tract

- Oral Cavity:
 - o Oral disease:
 - Dental caries, stomatitis (inflammation of the mouth), glossitis (inflammation of the tongue), cheilosis (inflammation in corner of the mouth), xerostomia (dry mouth), dysgeusia (distorted taste), ageusia (no taste)
 - Intervention/treatment: Modification of distribution, type, or amount of foods; texture modifications
- Esophagus:
 - o Gastroesophageal Reflux Disease (GERD):
 - Reflux of gastric contents into the esophagus due to incompetence of lower esophageal sphincter.

- Symptoms: dysphagia (swallowing difficulty), heartburn, belching, aspiration, pain radiating to back, neck or jaw
 - Intervention/treatment: Reduction of gastric acidity, increase LES, medical management, modify lifestyle (smoking, physical activity, small frequent meals, weight loss if warranted), surgery
- o Dysphagia:
 - Difficulty swallowing.
 - Symptoms: drooling, coughing, choking, weight loss, aspiration
 - Intervention/treatment: National Dysphagia Diets (Level 1: Pureed. Level 2: Mechanically altered. Level 3: Slightly more advanced but still not regular texture).
- o Achalasia:
 - Motility disorder with absence of peristalsis.
 - Elevated LES pressure.
 - Intervention/treatment: Texture modified diets, increased protein and caloric density, avoid extreme temperatures and spices, regular diet within 5-7 days.
- o Hiatal Hernia:
 - Herniation of a portion of the stomach into the chest through the esophageal hiatus of the diaphragm.
 - Sliding: Most common. Gastroesophageal junction moves above the diaphragm together with some of the stomach.
 - Rolling: When a part of the stomach herniates through the esophageal hiatus and lies beside the esophagus.
 - Intervention: Surgery
- Stomach:
 - o Dyspepsia (indigestion):
 - Symptoms: Bloating, belching, acidic taste
 - o Nausea and Vomiting:
 - Caused by drugs, toxins, and metabolic conditions.

- Intervention/treatment: Medications or antiemetics to minimize symptoms and discomfort, maintenance of nutritional status
- o Gastritis:
 - Inflammation of gastric mucosa (stomach lining)
 - Type A: Autoimmune
 - Type B: H. pylori
 - Primary cause is H. pylori bacteria. Also can be from alcohol, food poisoning, NSAIDS
 - Symptoms: belching, anorexia, abdominal pain
 - Intervention/treatment: Antibiotics and medications
- o Peptic Ulcer Disease:
 - Ulcerations of the gastric mucosa that penetrate submucosa
 - Gastric or duodenal
 - Possible causes: H. pylori, NSAIDS, alcohol, smoking, genetic link
 - Symptoms: Epigastric pain, burning sensation, presence of blood in the stool or vomit
 - Intervention/treatment: Relieved with antacids, surgery, triple/quadruple therapy of medications, maintaining or improving nutritional status
- o Gastric Surgery:
 - Complications of PUD (hemorrhage, perforation, obstruction)
 - Billroth I (removes part of the stomach and top half of the stomach is reconnected to the duodenum) and Billroth II (removes part of the stomach and top half of the stomach is reconnected to the small bowel)
 - Roux-en-Y (aka gastric bypass. Through surgery a small stomach pouch is constructed and creates an outlet directly to the jejunum)
 - Dumping syndrome (food “dumps” into the small intestine) can occur. Early dumping = 10-20 min, intermediate = 20-30 min, late dumping = 1-3 hours
 - Intervention/treatment: Post gastrectomy or “anti-dumping” diet: includes initiating slow progression of solid food, pts may initially be lactose intolerant so dairy should be avoided, initially avoid all simple sugars.

Pathophysiology of the Lower GI Tract

- Diarrhea:
 - Increase in frequency of bowel movements or increase in water content of stools
 - >200 g/day adults, > 20 g/day for children
 - Major complication is dehydration
 - Osmotic: increased water efflux due to an increase in osmolality; resolves when NPO
 - Secretory: underlying disease (bacteria, protozoa, viruses) causes secretions; does not resolve when NPO
 - Intervention/treatment: Treat underlying disease, antibiotics, NPO, low residue diet (BRAT), pro- and pre-biotics
- Constipation:
 - Decrease in frequency of bowel movements possibly due to IBS, rectal output obstruction, fecal impaction, adhesions, side effects of medications
 - Intervention/treatment: Increase whole grains, fruits, vegetables; 20-35 grams fiber per day; at least 2,000 mL fluid/day; pro- and pre-biotics
- Malabsorption:
 - Maldigestion of fat, carbs, and protein possibly due to decreased villous height, enzyme production, dysfunction of accessory organs due to disease
 - Steatorrhea: malabsorption of fat. Abdominal pain, cramping, diarrhea. Restrict fat 25-50 g/day, use of MCT supplements and pancreatic enzymes
 - Lactose Malabsorption. Increased gas, cramping, diarrhea. Restrict milk and dairy products, use products such as Lactaid
 - Protein Malabsorption: Protein-losing enteropathy due to destruction of GI tract, reduced serum protein.
- Celiac Disease:
 - Damage to the intestinal mucosa and villi due to exposure to gluten (in wheat, rye, barley, and malt).
 - Genetic and autoimmune
 - Infiltration of WBC, production of IgA antibodies
 - Can cause maldigestion and malabsorption

- o Symptoms: Diarrhea, cramping, bloating, gas, abdominal pain, bone and joint pain, skin rash, mouth ulcerations
 - o Intervention/treatment: Gluten-free diet for life, low-residue to minimize diarrhea, low-fat (45-50g, lactose-free, identify all hidden sources of gluten)
- Irritable Bowel Syndrome (IBS):
 - o Functional disorder
 - o Abdominal pain, alterations in bowel movements, gas
 - o Aggravated by stress, anxiety, and depression. Increased serotonin, inflammatory response
 - o Can lead to nutrient deficiency, malnutrition
 - o Intervention/treatment: decrease anxiety, normalize dietary patterns, assess nutritional adequacy, adequate fluid, pre-and pro-biotics
- Inflammatory Bowel Disease (IBD):
 - o Autoimmune, chronic inflammatory condition of the GI tract
 - o 2 types: Ulcerative colitis (ulcerated colon, thinning of colon wall) and Crohn's disease (thickening of colon wall, fistulas, obstruction, presents with skipping pattern throughout GI)
 - o Symptoms: Bloody diarrhea, abdominal pain, C-reactive protein elevated, WBC elevated, weight loss
 - o Intervention/treatment: antibiotics, immunosuppressants, surgery, enteral nutrition preferred over parenteral nutrition, supplement glutamine and arginine, may need to increase protein needs (1.5-1.75 g/kg), multivitamin, normalize dietary patterns, pro- and pre-biotics
- Diverticulitis/osis
 - o -Itis: Abnormal presence of outpockets or pouches on surface of the small intestine or colon. Fever, abdominal pain, GI bleeding. Foodstuff and bacteria can collect and result in infection.
 - o -Osis: Inflammation of these. Asymptomatic
 - o Risks are low fiber intake, increased colonic pressure, obesity, steroids, alcohol and caffeine, cigarette smoking

- o Intervention/treatment: -osis = high fiber diet + 6-10 grams, avoid nuts and seeds, fiber supplement. -itis: low-fiber diet, bowel rest, clear liquids, avoid nuts seeds and fibrous vegetables

Surgical Interventions for the Lower GI Tract

- Ileostomy: colon and rectum removed
- Colostomy: rectum removed
- Intervention: decrease risk of obstruction (avoid dried fruits, seeds, popcorn, drink adequate fluids), maintain fluid and electrolyte balance, reduce fecal output, minimize flatulence, multivitamin and B12 supplementation

CARDIOVASCULAR DISEASE (CVD)

Includes heart attack, stroke, angina, arrhythmias

Cardiovascular disease is the #1 killer in America

1 in 5 males and females has some form of CVD

Almost 150,000 Americans that are killed by CVD each year are under the age of 65

- Atherosclerosis:
 - A slow, progressive disease in which lesions are developed as a result of: injury to vessel wall (smoking, hypertension, oxidized LDL, diabetes) → proliferation of smooth muscle cells, macrophages, and lymphocytes → migration of smooth muscle cells into arterial walls, forming a matrix → accumulation of lipid, cholesterol, and other materials in matrix, making plaques.
 - Effect is high rigidity of blood vessel and low lumen size of blood vessels
 - Signs and symptoms: Typically a “silent killer” but with advancement = angina pectoris (precordial pain/pressure, high pulse, high BP) and acute myocardial infarction
 - Non modifiable risk factors: age, gender, family hx, race/ethnicity
 - Established, modifiable risk factors: high LDL, low HDL, high triglycerides, poor diet, physical inactivity, stress, hypertension, diabetes, obesity, metabolic syndrome, estrogen status

- LDL (“bad”) cholesterol is the primary blood lipid target for intervention efforts because it initiates and promotes atherogenesis.

Aging, genetics, diet, obesity, diabetes, nephrotic syndrome can all increase LDL levels.

Vitamin C, beta-carotene, reduced dietary saturated fat, trans fat, and cholesterol, increased fiber, plant sterols/stanols, and poly and mono unsaturated fats can decrease levels

- LDL Levels:
 - Desirable: < 100 mg/dL
 - Above desirable: 100-129 mg/dL
 - Borderline high: 130-159 mg/dL
 - High: 160-189 mg/dL
 - Very high: Greater than 190 mg/dL

- HDL (“good”) cholesterol can be increased by moderate fat diet, exercise, and loss of excess body fat, moderate consumption of alcohol.
Obesity, inactivity, cigarette smoking, high trig levels, high saturated fat and sugar intake can decrease it
- HDL Levels:
 - o Low: < 40 mg/dL (major risk for CVD)
 - o Acceptable for men: > 40 mg/dL
 - o Acceptable for women: > 50 mg/dL
 - o High: > than 60 mg/dL (considered protective against heart disease)
- Factors that increase triglyceride levels:
 - o Diet, estrogen, alcohol excess, obesity, untreated diabetes, hypothyroidism, liver disease. Factors that can decrease trigs are poly and monounsaturated fats, weight loss, smoking cessation, and limited simple sugars.
- Triglyceride Levels:
 - o Desirable: < 150 mg/dL
 - o Borderline high: 150-199 mg/dL
 - o High: 200-499 mg/dL
 - o Very high: > 500 mg/dL
- TLC Diet guidelines:
 - o Saturated fat: < 7% total calories
 - o Polyunsaturated fat: Up to 10% total calories
 - o Monounsaturated fat: Up to 20% total calories
 - o Total fat: 25-35%
 - o Carbs: 50-60%
 - o Fiber: 20-30 grams/day
 - o Protein: Approx. 15% total calories
 - o Cholesterol: < 200 mg/day
 - o Plant sterols/stanols 3-4 g/day
 - o Dietary soluble fiber: 8-10 g/day
- Metabolic Syndrome:
 - o Aggregation of risk factors related to insulin resistance.

- o Any 3 factors: waist circumference >35 in women and >40 in men; low HDL-c; high blood pressure (>130/85); TG >150; glucose >100.
 - o Exercise, weight control, high unsaturated fat diet
- Hypertension (chronic high blood pressure)
 - o 20 mmHg increased in SBP = 60% higher mortality from CVD
- Blood Pressure Levels
 - o Normal: SBP <120 DBP <80
 - o Prehypertension: SBP 120-139 DBP 80-89
 - o Stage 1 HTN: SBP 140-159 DBP: 90-99
 - o Stage 2 HTN: > or = 160 DBP > or = 100
 - o To treat: weight reduction, DASH eating plan, physical activity, moderate alcohol consumption (men < or = to 2 drinks/day, women < or = to 1 drink/day)
- DASH Diet Guidelines based on a 2,000 kcal diet:
 - o 7-8 servings grains and grain products
 - o 4-5 servings veggies
 - o 4-5 servings fruit
 - o 2-3 servings low or non fat dairy
 - o 2 or less meats, poultry, fish
 - o 4-5 per week nuts, seeds, and legumes

Diseases of the Liver, Gallbladder, and Pancreas

These diseases include Hepatic Diseases (Encephalopathy, Hepatitis, Cirrhosis, and Alcoholic Liver Disease), Cholelithiasis, and Pancreatitis.

Symptoms

- Encephalopathy- Begins with little awareness, small attention span, a sense of euphoria or depression or irritability, and being uncoordinated.
- Hepatitis- Jaundice, dark urine, anorexia, fatigue, headache, nausea, vomiting, and fever.
- Cirrhosis- Poor appetite, weakness, nausea, malaise, jaundice, dark urine, steatorrhea, itching, abdominal pain, and bloating.
- Alcoholic Liver Disease-Sometimes can be asymptomatic. Some symptoms can include anorexia, jaundice, dark urine, fever, and hepatomegaly.
- Cholelithiasis- Fever, diarrhea, vomiting, nausea, tenderness/pain in the upper right quadrant of the stomach.
- Pancreatitis- Can be asymptomatic. Some symptoms may include upper abdominal pain, steatorrhea, and Type II DM (chronic only).

Significant Labs/Clinical signs:

- Encephalopathy- Elevated serum ammonia levels, asterixis, neurological signs (unawareness, depression, etc).
- Hepatitis- Elevated bilirubin, alkaline phosphatase, and serum AST levels are common.
- Cirrhosis- The CTP and MELD tests are used as well as bilirubin and creatinine.
- Alcoholic Liver Disease- GGT, AST, and ALT are commonly elevated in patients with ALD.
- Cholelithiasis- No specific lab values associated with diagnosis. Diagnosed based on the symptoms.
- Pancreatitis- Elevated serum lipase and amylase levels are common. Ranson and Apache II tests are also used to help diagnose pancreatitis and its severity. Also diagnosed based mainly on symptoms.

Nutritional Management:

- Encephalopathy- The main problem with this disease is high ammonia levels, in order to lower ammonia levels, protein is restricted. Plant sources are recommended for protein consumption as well as dairy products; fiber is also increased.
- Hepatitis-People with hepatitis often have problems with inadequate intake, food-medication interactions, and impaired nutrient utilization. The goal of nutrition intervention is to prevent further cell damage and provide adequate nutrients for regeneration. This is done through small frequent meals often with calorie dense foods and supplements like Ensure. Alcohol is the only restriction.
- Cirrhosis- Malnutrition and vitamin/mineral deficiencies are common due to inadequate energy, protein, and vitamin/mineral intake. Recommended intake for energy is 35-40g/kg body weight. Recommended intake for protein is 1.6g/kg body weight; protein should also come from mostly plant and dairy sources. If the patient has signs of steatorrhea, they should be limited to less than 30% of kcal from fat.
- Alcoholic Liver Disease-Some nutrition problems include inadequate energy, protein, and vitamin/mineral intake; malnutrition; altered GI function; and involuntary weight loss. These are due to anorexia and intake of alcohol instead of food/nutrients. MNT for this disease is to provide adequate nutrients for regeneration of tissue. Treatment includes rest and adequate fluid intake. Patients are encouraged to consume 30-35kcal/kg body weight of energy, 1.5-2g/kg body weight of protein, and high complex CHO at 6-8g/kg body weights.
- Cholelithiasis- For acute cholelithiasis, NPO and bowel rest is recommended. Parenteral nutrition is used with lowered amounts of fat. Slowly progress back to a normal diet. For chronic cholelithiasis, lowered fat diet is recommended (25%) as well as gradual weight reduction and a diet higher in complex CHO and fiber. Water-soluble forms of fat-soluble vitamins may be necessary if there is fat malabsorption.
- Pancreatitis- For acute pancreatitis, NPO is recommended at first; new evidence now suggests that beginning re-feeding as soon as possible results in shorter hospital stays. They also no longer recommend starting with clear liquids and instead immediately starting oral intake. For chronic pancreatitis, the goal is to treat steatorrhea, correct malnutrition, and prevent weight loss. Frequent small meals with moderate to low fat can help reduce frequency of attacks. Fat should be as high as the patient can tolerate without

steatorrhea and/or pain. In addition, pancreatic enzymes may be given in order to help with digestion and absorption. Water-soluble forms of fat-soluble vitamins may be necessary if there is fat malabsorption.

RENAL DISEASE

Acute Renal Failure: Occurs when the kidneys suddenly stop functioning due to abrupt cessation or reduction in GFR

Symptoms

- Accumulation of nitrogenous waste
- Rapid declining status, loss in lean body mass, toxicity related symptoms
- Elevated BUN and Creatinine
- Prerenal azotemia
- Exposure to toxins
- Glomerulonephritis
- Sjogren's syndrome
- Kidney stone
- Blood clots
- Tumor

Significant Labs/Clinical signs

- Potassium
- Magnesium
- Phosphorus
- BUN must be kept between 80-100 mg/dl

Nutritional Management

- Protein: 0.6-0.75 g/kg
- If not dialyzed, GFR < 25 ml/min
- Calories: 30-40kcal/kg
- Sodium: 2 grams
- Fluids: Restrict only in patients with oliguria
- Provide calcium, folate and B6 supplements

Chronic Kidney Disease: Syndrome in which progressive loss of kidney function occurs.
Irreversible

Symptoms

- Stages 1 & 2 – kidney damage with normal or increased GFR, mild decrease in GFR

- Stage 3 - Moderate decrease: GFR 30-59 mL/min
- Stage 4 - Severe decrease: GFR 15-29 mL/min
- Stage 5 (ESRD) - Inadequate to sustain life
 - o GFR < 15 mL/min
 - o Uremia, hyperphosphatemia, azotemia, oliguria
 - o Sodium retention, edema, HTN
 - o Metabolic acidosis
 - o Hyperkalemia
 - o Microcytic anemia and iron deficiency
 - o Renal osteodystrophy

Significant Labs/Clinical signs

- BUN
- Creatinine
- Potassium
- PO₄
- Uric acid
- Magnesium
- Blood Pressure
- Calcium
- H&H
- Ferritin
- GFR

Nutritional Management

- **Predialysis: Stages 3&4**
 - o Maintain positive nitrogen balance
 - o Protein restriction
 - o GFR<25ml/min : 0.6-0.75 g/kg per day, >50% HBV
 - o Calories: 35 kcal/kg per day and 30 kcal/kg for >60 years of age
 - o Phosphorus: 800-1000 mg/day
 - o Sodium:1-3 gm/kg (Higher restriction with edema)

- **Hemodialysis: Stage 5**

- High in protein - 1-1.2 g/kg
- Control intake of potassium, phosphorus
- Sodium - 2-3 g
- Possible modifications in fat, cholesterol, TG
- Fluid - 1000 ml/day + urine output

- **Peritoneal Dialysis: Stage 5**

- High in protein - 1.2-1.3 g/kg (higher if peritonitis)
- High potassium
- Sodium - 6-8 g
- Limit phosphorus
- Energy needs slightly higher but is individualized
- Account for calories in dialysate
- Fluid - minimum 2000ml/day + urine output

***All: No added table salt. Try to quench thirst without drinking water (chewing on ice, eating cold fruit)**

Nephrotic Syndrome: Heterogeneous group of diseases - loss of glomerular barrier to protein

Symptoms

- Proteinuria
- Hematuria

Significant Labs/Clinical signs

- Nitrogen Balance
- Albumin
- Pre-albumin
- Calcium
- Sodium
- Phosphorus
- Potassium

Nutritional Management

- Protein: replace losses from urine
- Sodium: 2-3 g/day

- Energy: 35 kcal/kg BW/day
- Cholesterol lowering diet and drugs

DIABETES

Type 1: Characterized as an absolute deficiency of insulin due to destruction on pancreatic beta cells, resulting in the inability of cells to use glucose for energy.

Symptoms

- Polydipsia
- Polyuria
- Polyphagia

Significant Labs/Clinical signs

- Potassium
- Sodium
- Magnesium
- Phosphorus
- Serum osmolality
- Hemoglobin and Hematocrit
- Protein
- WBC count
- Creatinine
- Plasma glucose (both fasting and non-fasting)

Nutritional Management

- Total fat, saturated fat, cholesterol, fiber, vitamins and minerals are the same for every individual, whether diabetes is present or not
- Protein – 15-20% of daily kcals from protein and animal sources
 - o $\% \text{ PRO} = \text{grams protein} \times 4 / \text{total kcals}$
- Carbohydrates – 130 grams/day
 - o $\% \text{ CHO} = \text{grams carbs} \times 4 / \text{total kcals}$
- $\% \text{ FAT} = \text{grams fat} \times 9 / \text{total kcals}$
- Increase physical activity

Type 2: Non-insulin dependent.

Symptoms

- Nausea/vomiting

- Stomach pain
- Fruity or acetone breath
- Kussmaul respirations
- Mental status changes

Significant Labs/Clinical signs

- OGTT
- IGT
- IFG
- Blood glucose levels
- Fasting plasma glucose
- A1C

Nutritional Management

- Total fat, saturated fat, cholesterol, fiber, vitamins and minerals are the same for every individual, whether diabetes is present or not
- Protein – 15-20% of daily kcals from protein and animal sources
 - $\% \text{ PRO} = \text{grams protein} \times 4 / \text{total kcals}$
- Carbohydrates – 130 grams/day
 - $\% \text{ CHO} = \text{grams carbs} \times 4 / \text{total kcals}$
- $\% \text{ FAT} = \text{grams fat} \times 9 / \text{total kcals}$
- Increase physical activity

Diseases of the Respiratory System:

These diseases include Asthma, BPD (bronchial pulmonary dysplasia), COPD, Cystic Fibrosis, Respiratory Failure, and Transplantation.

Cystic Fibrosis (CF)-Affects the lungs, liver, pancreas, GI, reproductive system, and skin.

Treatments are focused mainly on lungs, pancreas, and GI.

Symptoms

- Asthma-Coughing, wheezing, dyspnea, and tightness of the chest.
- BPD- This is found primarily in premature infants (<32 weeks gestational age).
- COPD- Decreased airflow rates, dyspnea, hypoxemia, and hypercapnia (bronchitis). Dyspnea, orthopnea, hypercapnia, respiratory acidosis, extreme fatigue, and exhaustion (emphysema).
- CF- Most people are diagnosed by age three. Pulmonary symptoms include chronic cough and wheezing due to mucus. Pancreatic/GI- Steatorrhea, abdominal distention, and poor growth pattern despite normal appetite.
- Respiratory Failure- History of diseases such as COPD, CF, ALI, or ARDS.
- Transplantation- Only those that are significant of needing transplantation such as RF, CF, or severe COPD.

Significant Labs/Clinical signs

- Asthma- Diagnosed by symptoms and restriction of airways.
- BPD- Serum vitamin A levels may be low, but this is often diagnosed around the time the baby is born, since this affects premature babies.
- COPD- Diagnosed based on symptoms.
- CF- Sweat chloride test, blood test (to check for the CFTR gene), sputum cultures, pancreatic function tests, and pulmonary function tests.
- Respiratory Failure- Diagnosed based on history (COPD, CF) and symptoms.
- Transplantation- None.

Nutritional Management

- Asthma- Asthma generally increases with obesity rates, thus a primary measure would be to prevent obesity rates with a healthy balanced diet and exercise. Leukotrienes in the body contribute to the development of asthma, thus a diet with inhibitors to leukotrienes

is recommended. Leukotrienes are synthesized from Omega 6 FAs, thus Omega 3 FAs should be increased to interfere with the metabolism of Omega 6's. Antioxidants, specifically vitamin C is also recommended for the same reason.

- BPD- Breast milk or high-energy formulas are recommended. Supplementation with vitamin A and antioxidants is also recommended since low vitamin A levels and antioxidant damage may be related to the cause. A nasogastric feeding tube may be necessary. 15-20% higher energy needs may be necessary; energy-120-130 kcal/kg/day or higher and Protein 3-4 g/kg/day.
- COPD- Maintaining optimal energy balance to stay lean and healthy is important. 125-156% energy above BEE and 1.2-1.7 g/kg body weight of protein. Commercial formulas that are lower in CHO (30%) and higher in fat (50%) may be recommended.
- CF- Nutrition treatment is focused mainly on the pancreatic area of CF. Malabsorption of fats, malnutrition, and underweight are the most common nutrition diagnoses. The most common intervention is supplementation of pancreatic enzymes. Increased energy intake of (110%-200% of the RDA) may be necessary in cases of malabsorption. Increased fat intake (35-40%) is also recommended to compensate for fat malabsorption. For the same reason, fat-soluble vitamins may also need to be supplemented. Excess sodium may also be necessary, because much salt is lost in the sweat.
- Respiratory Failure- Meet nutrition needs. Enteral and/or parenteral nutrition support may be necessary. Vitamin and mineral supplementation may be necessary.
- Transplantation- Make sure nutritional status is as optimal as possible prior to surgery since it may decline post surgery. Post surgery, provide adequate nutrients to promote healing (increased protein and kcal), treat changes in electrolyte balance, and regulate blood glucose. Enteral/parenteral nutrition may be necessary.

Neoplastic Disease

Carcinogenesis- a multistep process in which normal cells are transformed into cancer cells.

This process may be enhanced with the help of carcinogens such as harmful chemicals, pollution, radiation, or infectious microorganism.

- Biomarkers are indicators that can be used to determine the amount or indicate the effects or progress of a disease or condition.

Cachexia is a condition that is common among cancer patients. Involuntary weight loss, tissue wasting, fatigue and metabolic alterations characterize it.

Prevention

- Primary Prevention- decrease the potential activity as a carcinogen such as promoting a healthier lifestyle
- Secondary Prevention- Early detection and screening

Signs and Symptoms

- Formation of a neoplasm
- Metastasis of a neoplasm
- Tumor markers are measured to check for tumor and indicate whether it has metastasized.
- CT scans
- PET Scans
- Mammogram

Nutrition Intervention for Cancer and Cachexia

- Enteral and parenteral nutrition support may not be beneficial to cancer patients because of the ongoing alteration of metabolism.
- The amount of calories needed can be determined by the Harris- Benedict equation, Mifflin St. Jeor, or by calculating needs based on body weight
 - o Obese patients 21-25 kcalories/kg
 - o Non ambulatory/sedentary adults 25-30 kcalories/kg
 - o Slightly hypermetabolic patients, patients who need to gain weight, or anabolic patients 30-35 kcalories/ kg
 - o Hypermetabolic patients, severely stressed patients, or patients experiencing malabsorption >35 kcalories/kg

- The amount of protein that needs to be consumed
 - o Normal or maintenance 0.8-1.0 g/kg
 - o Non stressed cancer patients 1.0- 1.5g/kg
 - o Bone marrow transplant or HSCT patients 1.5g/kg
 - o Wasting or hypermetabolism 1.5-2.5 g/kg
 - o Hepatic or Renal Compromise 0.5- 0.8 g/kg

Metabolic Stress

Metabolic stress is a hypermetabolic, catabolic response to acute injury or disease.

Factors

- Trauma
- closed head injury
- burns
- severe inflammation
- cancer
- sepsis
- hypoxic injury
- necrosis of tissue
- major surgery

Nutrition Therapy

- The amount of calories needed can be determined by using the Harris- Benedict or Mifflin St. Jeor equations. Activity factors, injury factors, and protein requirements should also be calculated.
 - Activity Factors
 - Out of bed 1.2
 - Confined to bed 1.1
 - Average Injury Factors
 - Surgery 1.0 – 1.3
 - Infection 1.0- 1.4
 - Skeletal trauma 1.2 -1.4
 - Head injury 1.5
 - Protein Requirements
 - RDA 0.8 g/kg
 - Minor Surgery 1.0 -1.1g/kg
 - Major Surgery 1.2 -1.5 g/kg
 - Burns 1.5- 2.0 g/kg

- Oral nutrition is the preferred route for meeting nutritional needs. If the patient is critically ill then enteral or parenteral nutrition is administered.
- The amino acids glutamine and arginine should be considered when feeding hypermetabolically stressed patients.
- Burns
 - Using direct calorimetry, Harris- Benedict equation, or Mifflin St. Jeor assesses energy requirements.
 - An equation that is specific to burns that can also be used is the Curreri equations.

HIV and AIDS

- HIV stands for Human Immunodeficiency Virus. It is defined as a virus that targets host cells and turns them into viral factories for HIV production.
- Primary HIV infection- the time of the initial seroconversion to HIV infection; usually involves a spike in the level of the virus and sometimes accompanied by flu- like syndrome.
- AIDS stands for Acquired immunodeficiency syndrome. It is defined as the immune dysfunction characterized by the destruction of immune cells, leaving the body open to infection.
- The screening test is called ELISA (enzyme linked immunoabsorbant assay)
- Disease Progression is linked to CD4 t-cell count.
 - Category 1 ≥ 500 cells/ μ L
 - Category 2 200-499 cells/ μ L
 - Category 3 < 200 cells/ μ L
- AIDS related wasting syndrome (AWS) is categorized as weight loss less than 10% without any known cause followed by fever or diarrhea for more than one month. Anthropometric measurements should be taken to assess whether muscle mass is also lost during this syndrome.
 - Criteria for AWS
 - Weight Loss
 - 10% or more in a year
 - 7.5% loss over 6 months
 - BMI < 20
 - Body Cell Mass
 - 5% loss over 6 months
 - $< 35\%$ of weight if BMI is less than 27 in men
 - $< 23\%$ of weight if BMI is less than 27 in women
- Other Symptoms that could result in malnutrition

- Barrett's Esophagus- pre malignant condition that is considered a risk factor for esophageal adenocarcinoma. It is a complication of GERD that is characterized by changes in the cells of the tissue that line the bottom of the esophagus.
- Dumping Syndrome- this condition occurs when food moves too quickly from the stomach to the small intestine.
- Steatorrhea- malabsorption of fat that results in severe diarrhea.
- **Side Effects of Chemotherapy**
 - Neutropenia
 - Thrombocytopenia
 - Anemia
 - Diarrhea
 - Mucositis
 - Alopecia
- **Side Effects of Radiation Therapy**
 - Fatigue
 - Mucositis
 - Dysguesia
 - Xerostomia
 - Dysphagia
 - Odynophagia

- **Clinical Lab Values**

TABLE 26.8

Selected Biochemical Measures in HIV Disease

Measure	Criteria or Expected Values	Evaluation in HIV Infection
Immunologic		
CD4 cell count	398–1535/ μ L	<200/ μ L defines AIDS; decreased levels are prognostic for opportunistic disease and often associated with body mass index levels
Viral load (PCR)	Undetectable	Elevated levels are prognostic for immune deficits
Hematologic		
Hemoglobin	F: 12.1–15.6 g/dL; M: 14.6–17.5 g/dL	Decreased in anemia; elevated in dehydration, chronic testosterone replacement
Hematocrit	F: 34–45%; M: 41–51%	Decreased in anemia; elevated in dehydration, chronic testosterone replacement
Mean corpuscular volume	78–93 cubic microns/RBC	Increased in folate or vitamin B ₁₂ deficiency anemia, associated with zidovudine; decreased in iron-deficiency anemia
Ferritin	F: 12–150 ng/mL; M: 30–320 ng/mL	Elevated in inflammation; decreased in iron-deficiency anemia
Transferrin	212–360 mg/dL	Elevated in iron deficiency; decreased in malnutrition
Albumin	3.5–5.0 mg/dL	Decreased in malnutrition; rapid decrease with acute inflammation
Prealbumin (Transthyretin)	18–38 mg/dL	Decreased in acute catabolism, inflammation, malnutrition
Organ Function		
AST	M: 10–37 U/L; F: 10–31 U/L	Elevated in hepatitis or due to medication interactions
ALT	M: 4–40 U/L; F: 4–31 U/L	Elevated in diabetes; low in malnutrition
BUN	8–23 mg/dL	Elevated in renal disease, wasting
Creatinine	Adult: 0.4–1.2 mg/dL	Elevated in renal disease, wasting
Endocrine		
Glucose	Fasting: 70–99 mg/dL	Elevated in diabetes, pancreatitis, chronic malnutrition
Insulin	Fasting: 427 uIU/mL	Elevated in metabolic syndrome, type 2 diabetes
Glycated hemoglobin A1c	4–6%	Elevated in diabetes, iron deficiency
Testosterone	350–1,080 ng/dL	Decreased in hypogonadism, AIDS wasting
Cardiovascular		
Total cholesterol	120–199 mg/dL	Elevated in hyperlipidemia, diabetes, obesity, infection
HDL	40–60 mg/dL	Decreased in starvation, obesity, diabetes, smoking, liver disease, AIDS
LDL	<100 mg/dL	Elevated in hyperlipidemia, lower in advanced AIDS
Triglycerides	Fasting: <150 mg/dL	Elevated in hyperlipidemia, AIDS
C-reactive protein (CRP)	Regular: <0.8 mg/dL	High sensitivity CRP will provide risk as low (<1 mg/L), average (1–3 mg/L), or high (>3 mg/L)
Electrolytes		
Sodium	136–144 mEq/L	Decreased in diarrhea, vomiting, AIDS
Potassium	3.5–5.5 mEq/L	Decreased in diarrhea, vomiting, chronic stress/fever

- **Nutritional Assessment**

TABLE 26.10

Nutrient-Based Therapy Recommendations

Nutrient	Recommendations
Fluids	Hydration maintenance is the goal, and standard fluid intake recommendations can apply; additional fluids are recommended in cases of dehydration, fluid losses through diarrhea or sweating; restrictions are recommended in cases renal insufficiency
Kcal	Weight maintenance is the goal with additional kcal typically recommended if weight gain is desired and a mild restriction in kcal to achieve desired weight losses; additional energy may be required during bouts of opportunistic conditions that increase metabolic rate; increased kcal requirements during pregnancy and lactation should be incorporated into recommendations
Carbohydrate	The amount and types of carbohydrate recommended are based on both energy needs and carbohydrate tolerance; insulin resistance and diabetes may require dietary modification to modulate glucose and insulin levels
Protein	The amount and types of protein recommended are based on the need for protein stores maintenance; additional protein is likely to be needed in cases of inflammation, fever, and during pregnancy; any protein losses should be restored with increased protein intake and activity to promote protein stores maintenance; renal disease or other conditions may require protein restriction or other changes in protein recommendations
Fat	The amount and types of fat recommended are based on energy needs, cardiovascular risk, and inflammatory conditions; weight maintenance may require increases or decreases in fat kcals; cardiovascular risk may require lower fat intake and a higher ratio of unsaturated fats; omega-3 fatty acid sources may be recommended to help reduce inflammation effects as well as improve lipid profiles
Vitamins and minerals	Recommendations are based on individual needs; for instance, during bouts of diarrhea, the replacement of electrolytes and any potential losses of vitamins and minerals (such as fat-soluble vitamins during steatorrhea and zinc during larger volume losses of fluids) are essential to balance; upper limits of toxicity, the potential for nutrient interactions with medications and disease, and balance in micronutrient intake should be considered in recommendations (for instance, iron supplementation is controversial due to the potential for increasing the risk of opportunistic infection without overcoming the inflammatory-mediated drop in iron availability); specific conditions that alter micronutrient requirements, such as pregnancy and lactation or child growth and development, should be considered in recommendations
Fiber	Fiber recommendations are similar to those in healthy individuals and fiber has been suggested to improve glucose tolerance, affect glycemic response to foods, and reduce the potential for cardiovascular risk and altered fat deposition seen in lipodystrophy

