



# Preparation for Dietetic Practice



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*Clinical Nutrition Modules*

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# Preface

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## Accessibility

This book was designed with accessibility in mind so that it can be accessed by the widest possible audience, including those who use assistive technologies. The web version of this book has been designed to meet the [Web Content Accessibility Guidelines 2.0, level AA](#).

While we aim to ensure that this book is as accessible as possible, we may not always get it right. There may be some supplementary third-party materials, or content not created by the authors of this book, which are not fully accessible. This may include videos that do not have closed captioning or accurate closed captioning, inaccessible PDFs, etc.

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# Introduction

## How to Use This Book

This book is designed to prepare dietetic students for practical training. Students can choose to review each module in the order that they appear or to select modules that are most appropriate to prepare for their nutrition care placements.

Each module of this book is presented in 4 sections following the Nutrition Care Process (NCP). Some modules include a background section to provide further information. Students should review the module in the order the sections are presented to understand how the NCP is developed for each clinical area of practice presented. Case studies will also allow students to apply the content presented in the modules.

To navigate through the book, click on the CONTENTS side bar found on the left of the page. This will open to reveal all modules and sections included in this book. Within each section of the module you will find interactive questions to test your knowledge, links to external resources and a simulation video demonstrating key learnings.

The simulations provide students with opportunities to make decisions and to see how the client could respond to those decisions. It is just as important to see what not to do as the dietitian demonstrates in the incorrect responses, as it is to see what to do in the correct responses. We suggest that students view all decisions in each of the simulations.

# The Nutrition Care Process

To learn more about the Nutrition Care Process, please read [“Nutrition Care Process and Model Update: Toward Realizing People-Centred Care and Outcomes Management”](#). A citation to this journal article is below:

Swan WI, Vivanti A, Hakel-Smith NA, et al. Nutrition Care Process and Model Update: Toward Realizing People-Centered Care and Outcomes Management. *J Acad Nutr Diet*. 2017;117(12):2003-2014. doi:10.1016/j.jand.2017.07.015

# DIABETES

Welcome to the Nutrition Care for Diabetes module. This module will cover the four steps of the Nutrition Care Process (Assess, Plan, Implement, and Evaluate) for patients and clients living with diabetes. Please follow along with the case study for Penelope in the coloured boxes to practice. There are also interactive activities throughout the module to check your learning.



*Oral medication adherence and monitoring blood sugars with a glucometer may be part of your client's diabetes management plan. Photo by [Nataliya Voitkevich](#) on [Pexels](#)*

## Learning Outcomes

By the end of this module, you will be able to:

1. Identify where to gather clinical, anthropometric, biochemical, and dietary data necessary to complete a nutrition assessment for a client living with diabetes.
2. Interpret biochemical values and diagnostic test values, including OGTT, FBG, A1C, random BG, TC, HDL, LDL, TG, ACR, serum Cr, and eGFR.
3. Analyze the 8 areas of nutrition concern (hypoglycemia, hyperglycemia, medication and insulin, carbohydrate intake, macronutrient distribution, meal timing, cholesterol, physical activity) in clients living with diabetes and form PES statements for each.
4. Determine likely causes for hypo- and hyperglycemia and recommend methods to treat and prevent each through medication and insulin adjustments, diet, and/or physical activity.
5. Recognize strategies, such as Carb Counting and the Plate Method, to maintain optimal blood sugar control through dietary changes.
6. Identify strategies to lower LDL cholesterol for clients living with diabetes.
7. Understand the roles of 6 members of the diabetes interdisciplinary team, including the endocrinologist, physician, nurse practitioner, diabetes nurse educator, social worker, physiotherapist, and chiroprapist.
8. Recognize effective strategies, such as Motivational Interviewing and SMART goal setting, to provide education and support behaviour change in those living with diabetes.
9. Evaluate the nutrition care plan using assessment data relevant to the client's nutrition concerns.

# Assess



## Setting the Agenda

Before you begin your assessment or any interaction with a client, make sure to:

1. Start out by greeting them and introducing yourself.
2. Describe the role of a registered dietitian relevant of their diabetes care.
3. Invite them into the conversation to build rapport and be an active participant in their health care.
4. Set the agenda for the appointment by asking about what brings them in and how you can help with the management of their diabetes.



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=184#h5p-1>

# Gathering Data for an Assessment

When gathering data for your assessment make sure to collect information on the patient's:

- Clinical Data (both Medical history and Social history)
- Anthropometric Data
- Biochemical Data
- Dietary Data

## Case Study: Meet Penelope



*Penelope  
Kelly, your  
client*

You are playing the role of Katie, a dietitian in a diabetes program at a Community Health Centre outside of Toronto. You have received a referral from Dr. Darlington to see a client. Your client Penelope Kelly, is a 50 year old woman

living in Barrie with her husband and 2 children. The reason for referral is related to her hypertension, recent diagnosis of Type 2 diabetes, and interest in losing weight. She has coverage for her medication, and has used the food bank in the past because she couldn't afford food. She feels too tired to exercise and walks 15 minutes to the grocery store once a week. She wants to lose weight because she would like to have more energy and be healthier. The client is meeting with you this afternoon.

## Clinical Data

### Medical History

When gathering clinical data, consider:

- **Diagnosis:** Do they have prediabetes, type 2 diabetes, or gestational diabetes? Are they at risk of developing diabetes? How long have they had diabetes?
- **Past Medical History:** Do they have other medical conditions (e.g. hypertension, dyslipidemia, cardiovascular disease, schizophrenia, depression, bipolar disorder, polycystic ovary syndrome, sleep apnea)?
- **Family History:** Did members of their family have diabetes or other medical conditions?
- **Symptoms:** Do they experience any complications of poor diabetes management (e.g. polydipsia, polyuria, neuropathy, nephropathy, sexual dysfunction, or problems with their vision, feet, or gums)?

- **Interdisciplinary team:** Do they regularly see an endocrinologist, chiropractist, dentist, optometrist, or nephrologist?
- **Medications:** Are they on any oral anti-hyperglycemic agents, non-insulin injectables, and/or insulin? Blood pressure or cholesterol medications? Are they taking any supplements?
  - **Insulin** is a very effective medication in managing all types of diabetes. To learn more, read [Diabetes Canada's resources on insulin.](#)

## Medications

When gathering medications as part of the nutrition assessment, refer to the [Diabetes Medication Chart](#). This chart summarizes the various types of oral hypoglycemic agents and any medications used for lowering blood pressure and cholesterol, and their side effects, nutrition interactions, and the parts of the body they act on to help control blood sugar.



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## Penelope's Medical History

- **Diagnosis:** Type 2 diabetes (diagnosed 2 weeks ago)
- **Past Medical History:** Hypertension
- **Medications:** Dr. Darlington has discussed with Penelope that rather than start her on medications for diabetes or blood pressure, he would like to follow up with her in 2 months to see if her blood pressure and blood glucose can be controlled with changes in her diet and weight.
  - 500 mg calcium
  - 1000 IU vitamin D
  - 60 mg Diamicon (once daily with breakfast)

## Social History

It's also important to gather information on the client's social history, which will help you to tailor your nutrition plan later on. When gathering social history, consider:

- **Housing:** What is their living situation? Do they live with others? Do they have a support system? Do they have access to a kitchen?

- **Income:** Are they currently working? What is their main source of income?
- **Insurance:** Do they have medical coverage?
- **Substance use:** Smoking? Alcohol? Any other substances?
- **Food security:** Has anyone in their household gone without food in the past month because they couldn't afford it? Do they ever have to use the food bank or skip meals because they do not have enough money for food?
- **Physical activity:** Do they have any mobility issues (short or long-term)? Are there barriers preventing them from getting physically active (e.g. living in an unsafe area makes it difficult to get outside to exercise)?

## Penelope's Social History

- **Housing:** Lives in Barrie with her husband and 2 children.
- **Income:** Not currently working (laid off), living off savings, has not qualified for social assistance.
- **Insurance:** Has medical coverage.
- **Food security:** Occasionally uses food bank, does not skip meals.
- **Physical activity:** Sedentary most days due to fatigue, walks 15 minutes to the grocery store and back once a week.

# Anthropometric Data

When gathering anthropometric data from the client, consider:

- **Weight:** Current body weight in kilograms. If the client is open to having this taken, it can be valuable to know as part of their weight history.
- **Weight History:** Do they have an interest in weight loss? Have they tried to lose weight before? Has their weight recently fluctuated? What was their highest and lowest adult body weight?
- **Waist Circumference:** Current waist circumference in cm. If the client is open to having this taken, it can be a valuable screening measurement.
- **Height:** Current height in centimetres.
- **BMI:** Body Mass Index.

It's important to ask if the client is comfortable having these measurements taken as this may trigger stress for some clients. If the client states that weight loss is a goal for them, it can be helpful to know:

- Why that goal is important for them.
- If they have tried to lose weight before.
- Any diets they have tried in the past.
- How their weight has fluctuated over the years.

## Penelope's Anthropometric Data

- **Weight:** 76.5 kg (Usual Body Weight for the past several years)
- **Height** = 162.5 cm
- **BMI** = 29 kg/m<sup>2</sup>
- **Weight History**
  - Lowest adult body weight = 67 kg (15 years ago)
  - Has tried many diets in the past; some weight cycling
  - She would like to lose weight to feel healthier and have more energy

## Biochemical Data

### Diagnostic Criteria

You may need to interpret Oral Glucose Tolerance Test (OGTT), Fasting Blood Glucose (FBG), and Random Blood Glucose (RBG) values for a client to see if they are at risk of diabetes, have pre-diabetes, or are newly diagnosed with diabetes. The most common lab value you will use is Glycated Hemoglobin (HbA1C or A1C), as

this can tell you how well their diabetes and blood sugars have been managed over the past 3 months.

### Lab Tests to Diagnose Diabetes

Lab Test	Definition	Normal	Pre-DM	Type 2 DM
<b>OGTT</b>	Oral glucose tolerance test: Challenge body with 75g glucose load. Test PG pre and 2 hrs post (mmol/L)	< 7.8	7.8 – 11.0	≥ 11.1
<b>FPG/ FBG</b>	Fasting plasma/blood glucose: At least 8 hrs of fasting (mmol/L)	4.0 – 6.0	6.1 – 6.9	≥ 7.0
<b>Random PG/BG</b>	Plasma/blood glucose: Tested at anytime (mmol/L)	< 11.1	–	≥ 11.1
<b>A1C</b>	Glycated hemoglobin: 3 month average plasma glucose concentration	< 6.0%	6.1% – 6.4%	≥ 6.5%

## Target Ranges

Once someone has been diagnosed with diabetes, the target ranges for A1C and blood sugars vary depending on age. When assessing blood sugar values with a client, you'll want to gather information about their self-monitoring of blood glucose (SMBG). It's important to ask them:

- Do you use a glucose meter to check your blood sugars?
- How often do you check your blood sugars?
- Have you noticed any trends or patterns?
- Do you use a logbook to keep track of your **BG** levels?

All of this information helps you to get a good picture of how their diabetes is managed.

### Target Ranges for Diabetes Management

Client	A1C	FBG/BG before eating (mmol/L)	BG 2 hours after eating (mmol/L)
Type 2 Children	≤ 7.0%	4.0 – 7.0	5.0 – 10.0 * 8.0 if A1C not met
Type 1 + Type 2 Adults	≤ 7.0%	4.0 – 7.0	5.0 – 10.0 * 8.0 if A1C not met
Gestational	≤ 6.0%	3.8 – 5.2	5.0 – 6.6
Frail Elderly	≤ 8.5%	5.0 – 12.0	Individualize

## Lipids

You also want to collect and assess any blood work they've done for lipids, including total cholesterol, **HDL** and **LDL** cholesterol, and triglycerides. Getting a blood pressure measurement is also helpful to see if they are on target; the **BP** control target is < 130/80 mmHg.

### Target Ranges for Lipid Management for People Living with Diabetes

Lab Test	Definition	Normal	Target
<b>TC</b>	Total cholesterol: amount of total cholesterol in blood	< 5.2 mmol/L	≤ 4.0 mmol/L
<b>HDL - Chol</b>	High density lipoprotein “good” cholesterol: absorbs cholesterol and carries it back to liver	≥ 1.0 mmol/L	≥ 1.0 mmol/l (for men) ≥ 1.3 mmol/l (for women)
<b>LDL - Chol</b>	Low density lipoprotein “bad” cholesterol: leading to plaque build up resulting in heart disease	< 3.5 mmol/L	≤ 2.0 mmol/L
<b>TG</b>	Triglycerides: fat found in blood used for energy; excess fat storage	≤ 1.7 mmol/L	≤ 1.7 mmol/L

## Urinalysis and Renal Function

You also want to check lab work for any evidence of diabetic nephropathy and reduced kidney function. Albumin/creatinine ratio, Serum creatinine, and **eGFR** are all tests that are used in screening for renal disease. It is also worth noting any glucose or ketones present in the urine as this may indicate that blood sugars are not well controlled. These are also discussed in more detail in the [renal nutrition module](#).

### Additional Lab Tests for Diabetes Management

Lab test	Normal	Indication of reduced renal function
Albumin/creatinine ratio (ACR)	$\leq 2.0$ mg/mmol	$\geq 2.0$ mg/mmol
Serum Creatinine	-	Will be elevated ( $>110$ mmol/L)
eGFR	$> 90$ mL/min	$\leq 60$ mL/min

## Penelope's Biochemical Data

**Lab results:** Here are the labs for Penelope. Determine which lab values are within normal limits (WNL) or are elevated. This information will be used when planning the nutrition care plan in the next section.

### Penelope's Lab Results

Lab Test	Lab Result	Target Range
A1C	7.5%	$\leq 7.0\%$
Random BG	11.0 mmol/L	5.0 - 10.0 mmol/L
TC	3.6 mmol/L	$\leq 4.0$ mmol/L
LDL	1.45 mmol/L	$\leq 2.0$ mmol/L
HDL	1.9 mmol/L	$\geq 1.3$ mmol/L
TG	1.2 mmol/L	$\leq 1.7$ mmol/L

**Blood glucose log:** Here is a snapshot of Penelope's blood

sugar log. You can see that her fasting blood sugars have been less than 4 most mornings, around 3 before lunch when she is feeling low, and around 10 or higher 2 hours after dinner.

#### Penelope's Self-Monitored Blood Glucose (SMBG) Results

Day of week	FBG (mmol/L)	AC Lunch (mmol/L)	2 hours after dinner (mmol/L)
M	3.5	3.3	11.6
Tu	5.0	-	12.0
W	4.3	3.6	11.2
Th	3.9	3.1	9.5
F	6.3	-	13.4
S	3.8	3.4	11.1

**SMBG:** Penelope tests her blood sugar twice per day due to cost, but has recently been testing an additional time before lunch because she's been feeling shaky and very hungry.

**BP:** 154/94 mmHg



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# Dietary Data

When gathering dietary data, consider the client's:

- **Eating behaviours:** How many meals per day? How many hours between their meals and snacks? Eating at home or eating out?
- **Food access and food skills:** Do they have access to a kitchen? Do they get groceries and/or cook at home, or does someone else do this for them? Previous nutrition education? What do they know about managing their diabetes and BG with diet choices?
- **Diet History:** 24-hour recall, 3-day food record, and/or food frequency questionnaire (FFQ). Pop, juice, sweets, alcohol, fast food? Have they tried any diets in the past?

## Penelope's Dietary Data

- **Food access and food skills:** Penelope does the majority of the grocery shopping while her husband Bob works. Penelope and Bob want to teach their children healthy habits. They are motivated to make changes as a family. She had accessed the food bank to help supplement the family's cupboard while Bob was also laid off.
- **Diet History (24-Hour Recall):**

### Penelope's 24-hour Diet Recall

Meal	Penelope's diet recall
<b>Breakfast</b> 7 am	2 eggs, 2 pieces bacon, lettuce, 1 rice cake, 15 mL mayo
<b>Lunch</b> 12 pm	2 chicken breasts with skin, 2 cups salad—mostly lettuce, tomato, cucumber, red peppers, 60 mL dressing, 250 mL chocolate milk
<b>Dinner</b> 5:30 pm	6 ounces baked fish, 2 cups mashed potatoes, ½ cup corn, 2 tbsp butter, 2 cups unsweetened apple juice
<b>HS snack</b>	¼ cup “fat free” baked pita chips

## Simulation Activity: Penelope



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PART 1: ASSESS COMPLETE. Pause to reflect on the

assessment strategies discussed. When you're ready, move on to Part 2: Plan.

# Plan



## Diabetes Management

### ABCDES

When creating a care plan, you want to consider the ABCDES of diabetes management:

**ABCDES of Diabetes Management, adapted from [Diabetes Canada Clinical Practice Guidelines](#)**

<b>Initial</b>	<b>Value</b>	<b>Description</b>
<b>A</b>	<b>A1C targets</b>	Optimal glucose control (usually $\leq 7\%$ )
<b>B</b>	<b>BP targets</b>	Optimal blood pressure control ( $< 130/80$ mmHg)
<b>C</b>	<b>Cholesterol targets</b>	LDL-C $\leq 2.0$ mmol/L if decision made to treat (see <a href="#">algorithm and Risk Assessment Tool</a> )
<b>D</b>	<b>Drugs</b>	For protecting the heart, even if the baseline blood pressure or LDL-C is already at target
<b>E</b>	<b>Exercise/ Eating</b>	Regular physical activity, healthy eating, achievement and maintenance of healthy body weight. Aim for 150 mins of moderate to vigorous aerobic activity per week and resistance exercise 2-3 times per week.
<b>S</b>	<b>Smoking cessation</b>  <b>Self-management Screening for complications</b>	Provide education on smoking cessation.  Assess barriers to achieving self-management goals (stress, finances, social supports etc.) Cardiac: ECG every 3-5 years if age $> 40$ OR diabetes complications Foot: Monofilament/Vibration yearly or more if abnormal Kidney: Test eGFR and <b>ACR</b> yearly, or more if abnormal Retinopathy: yearly dilated retinal exam

## Creating a Nutrition Care Plan for Diabetes

Make sure to review the following 8 key areas:

- Hypoglycemia
- Hyperglycemia
- Medication and Insulin
- Carbohydrate (CHO) Intake
- Macronutrient Distribution

- Meal Timing
- Cholesterol
- Physical Activity

## Common PES Statement Terminology

As you interpret the data from the assessment, you can form Problem, Etiology, Symptoms (PES) statements or nutrition diagnoses that help identify nutrition concerns that need to be addressed in your plan. If you are not familiar with how to write a PES statement please review this [resource from the Academy of Nutrition and Dietetics](#).

Here are some common nutrition problems that patients with diabetes experience.

- Excessive energy intake
- Less than optimal intake of types of carbohydrate (specify)
- Food- and nutrition-related knowledge deficit
- Not ready for diet/lifestyle change
- Physical inactivity
- Unintended weight loss
- Altered nutrition-related laboratory values (specify)
- Inconsistent carbohydrate intake
- Less than optimal intake of types of fats (specify)
- Disordered eating pattern
- Inability to manage self-care
- Impaired ability to prepare foods/meals

You can create a PES statement for Penelope as we go through each of the 8 key areas.

Here is Penelope's biochemical data from the assessment section. It may be helpful to refer to when creating your PES statements.

### Penelope's Lab Results

Lab Test	Lab Result	Target Range
A1C	7.5%	≤ 7.0%
Random BG	11.0 mmol/L	5.0 – 10.0 mmol/L
TC	3.6 mmol/L	≤ 4.0 mmol/L
LDL	1.45 mmol/L	≤ 2.0 mmol/L
HDL	1.9 mmol/L	≥ 1.3 mmol/L
TG	1.2 mmol/L	≤ 1.7 mmol/L

## Hypoglycemia

If you identified hypoglycemia as a problem from your assessment, then this needs to be prioritized in your care plan as it presents a high risk.

Make sure clients know the **signs and symptoms** of hypoglycemia, which can include: shaking/trembling, fast heartbeat, sweating, dizziness, hunger, blurred vision, headache, confusion, weakness/fatigue, anxiousness or irritability. In addition, nocturnal hypoglycemia may cause: vivid dreams or nightmares, restless sleep, morning headache, or night sweats.

Make sure clients know how to treat hypoglycemia using **the 15:15 rule**. If their BG is less than 4.0 mmol/L, they can follow these steps:

1. Take 15g of simple CHO (carbohydrate): For example ¾ cup juice or regular pop; 3-4 glucose tablets; 3 packets of sugar
2. Recheck BG after 15 minutes
  - If above 4.0: have a balanced snack or meal
  - If below 4.0: re-treat with 15g CHO

You also need to think about the potential **causes** of the

hypoglycemia and advise the client on measures they can take to prevent low blood sugars from happening in the first place. Causes include: more physical activity than usual, taking too much medication, not eating on time or eating less than usual, and drinking alcohol.



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## Penelope's Hypoglycemia

**PES:** Hypoglycemia related to inconsistent carbohydrate intake, as evidenced by feelings of hunger and shaking/trembling before lunch.

- Treat: use the 15:15 rule
- Prevent: encourage Penelope to include CHO at all meals, especially breakfast

Her lows before lunch are likely related to her lack of carbohydrates at breakfast, which is evidenced in her 24-hour recall.

Make sure Penelope recognizes the signs and symptoms of low blood sugar and has a plan in place for treating it if it happens again. For example, if she wakes up and has a BG of 3.5 mmol/L, she should have  $\frac{3}{4}$  cup of juice and follow the 15:15 rule before having breakfast.

You also want to try to prevent her hypos in the morning and before lunch by encouraging Penelope to include carbs at all meals, especially breakfast.

## Hyperglycemia

If you identified frequent hyperglycemia as a problem from your assessment, then this needs to be prioritized in your care plan as it presents a risk for developing **long-term complications** (e.g. eye damage or diabetic retinopathy, heart disease, stroke, hypertension, kidney disease, nerve damage and amputation, gastroparesis, erectile dysfunction).

Make sure clients know the **signs and symptoms** of hyperglycemia, which can include: dry mouth, thirst, frequent urination, and blurred vision.

Think about the potential **causes** of the hyperglycemia (e.g. imbalance of food, certain medical conditions, stress, and some medications) and advise the client on measures they can take to prevent high blood sugars.

When **treating** hyperglycemia, consider the BG:

- If BG is frequently more than 11 mmol/L: adjust medication and/or insulin, adjust dietary patterns, and increase physical activity
- If BG is more than 20 mmol/L: seek immediate medical attention



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## Penelope's Hyperglycemia

**PES:** Hyperglycemia related to excessive carbohydrate intake at dinner, as evidenced by BG > 11 mmol/L 2 hours after dinner and diet history.

To prevent hyperglycemia, encourage Penelope to

include CHO at all meals, and reduce the portion size of CHO at dinner.

Penelope's hyperglycemia in the evening is likely related to her excessive carbohydrate intake at dinner. The most effective plan to reduce Penelope's high blood sugars in the evening and help to keep them controlled throughout the day, is to encourage her to include carbs at all meals and reduce the portion size of carbs at dinner.

## Medication and Insulin

If a client is experiencing hypo- or hyperglycemia that you think may be related to medication and insulin, check the following:

- Are they taking their medication and insulin at the times prescribed?
- Does the type of medication commonly cause hypoglycemia?
- Where are they injecting?
- Are they rotating their insulin injection sites? How often?
- Are they changing the needle/pen tip every time?
- Are they waiting 10 seconds before removing the needle from the skin?
- Do they see any insulin leaking out of the injection site?



Photo by [Nataliya Yaitkevich](#) on [Pexels](#)

Liaise with the client's Primary Care Provider (PCP) regarding medication or insulin education, or changes, if needed. This is especially important if a client is experiencing hypo- or hyperglycemia that you think may be related to medication and insulin.

## Carbohydrate Intake

To maintain optimal blood sugar control throughout the day clients can be encouraged to try to:

- Choose carbohydrate foods with low glycemic index (beans, lentils, whole grains, most vegetables and fruits) as they contain fibre which slows the absorption of sugar into the blood.

- Limit simple sugars (regular pop, desserts, candies, jam, and honey) as they raise blood sugars rapidly.
- Check food labels for hidden sugars (agave, corn syrup, dextrose, fructose, glucose, maltose, maple syrup, molasses, raw sugar, sucrose, etc.).
- Use the Nutrition Facts table when Carb Counting to determine the amount of carbohydrate in 1 serving.

Carb Counting is a great method to recommend for keeping portions equal throughout the day. Carb Counting is more appropriate for a client who has a high literacy level and is committed to spending time planning their diet as a part of their diabetes management.

For more information, read [Diabetes Canada's "Basic Carbohydrate Counting" \(PDF\)](#) resource.

## Macronutrient Distribution

To maintain optimal blood sugar control throughout the day clients can be encouraged to try to:

- Eat around the same amount of carbohydrate-containing foods at each meal.
- Include protein and unsaturated fats with carbohydrates at meals and snacks to slow the absorption of sugar into the blood.
- Use the plate method ( $\frac{1}{2}$  vegetables,  $\frac{1}{4}$  grains and starches,  $\frac{1}{4}$  protein).

A suggested pattern for meals and snacks could consist of:

- Breakfast: 1-2 servings **CHO** + protein
- Lunch/Dinner: 2-3 servings of CHO + protein + 1-2 cups

vegetables

- Snacks: 1 serving CHO + protein

When working with those with diabetes, the plate method is commonly used when helping clients to balance their meals and snacks. Clients who require a simpler explanation of carbohydrate portioning can benefit from using the plate method to help manage their diabetes with their diet.

For more information, read [Diabetes Canada's "Just the Basics" \(PDF\)](#) resource.



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## Penelope's Carb Intake and Macro Distribution

**PES:** Inconsistent carbohydrate intake related

to food and nutrition knowledge deficit of appropriate amount of dietary carbohydrate, as evidenced by variations in BG levels and diet history.

A component of Penelope's nutrition care plan to reduce hypoglycemia and hyperglycemia involves using Carb Counting or the Plate Method. This may help to evenly distribute the carbohydrates throughout the day at each meal so they are not all at dinner, and will help to make sure she is combining protein with carbohydrates at meals and snacks to slow the absorption of the sugars into her blood.

After discussing these options with Penelope she decides she would like to try the plate method, which you use to help her make changes to her diet. The changes are noted below.

### Suggested Dietary Changes

[\*] indicates changes in foods or portions

Meal	Penelope's diet recall	Dietary suggestions
Breakfast 7 am	2 eggs, 2 pieces bacon, lettuce, 1 rice cake*, 15 mL mayo	<ul style="list-style-type: none"> <li>Substitute 1 rice cake for 2 slices of whole grain bread* (by having her eggs and bacon as a sandwich)</li> <li>These are high fibre CHO choices that will help keep her BG stable throughout the morning until she eats her lunch</li> </ul>
Lunch 12 pm	2* chicken breasts with skin, 2 cups salad (mostly lettuce, tomato, cucumber, red peppers), 60 mL dressing, 250 mL chocolate milk	<ul style="list-style-type: none"> <li>Reduce chicken from 2 breasts to 1 breast*</li> <li>Add ½ cup of brown rice*</li> </ul>
Dinner 5:30 pm	6 oz baked fish, 2 cups* mashed potatoes, ½ cup corn*, 2 tbsp butter, 2 cups unsweetened apple juice*	<ul style="list-style-type: none"> <li>Reduce mashed potatoes from 2 cups to 1 cup*</li> <li>Substitute ½ cup of corn with 1 cup of broccoli*, which is her favorite vegetable</li> <li>Substitute 2 cups of apple juice for 1 can of diet pop* to help reduce CHO portions at dinner; she doesn't like plain water, but is willing to switch to diet pop</li> </ul>

<p><b>HS snack</b></p>	<p>¼ cup* “fat free” baked pita chips</p>	<ul style="list-style-type: none"> <li>• If her BG is 4-5 mmol/L when she tests at bedtime, she should have a bigger snack with some CHO and protein to help prevent low blood sugars overnight:             <ul style="list-style-type: none"> <li>◦ Increase pita chips portion from ¼ cup to 1 cup*</li> <li>◦ Add 3 tbsp of hummus*</li> </ul> </li> <li>• If <b>HS</b> BG is higher than 5 mmol/L, there is no need for a snack</li> </ul>
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## Meal Timing

To maintain optimal blood sugar control throughout the day clients can be encouraged to try to:

- Eat three meals per day at regular times, including snacks between meals, if needed.
- Space meals and snacks about 4 hours apart (and no more than 6 hours apart).



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<https://pressbooks.library.torontomu.ca/dietmods/?p=236#h5p-28>

## Penelope's Meal Timing

**PES:** Adequate meal timing as evidenced by diet history.

No meal timing changes required at this time.

## Cholesterol

To lower LDL cholesterol, clients can be encouraged to try to:

- Choose unsaturated fats (olive oil, canola oil, nuts and seeds, fatty fish, soft non-hydrogenated margarine) more often than saturated fats (fatty meats, cream, butter).

- Avoid trans fats (found in some highly processed foods).
- Choose foods high in soluble fibre (beans, oats, fruit, some vegetables).
- Consider adding psyllium husk (like Metamucil) to meals or snacks, once per day.



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<https://pressbooks.library.torontomu.ca/dietmods/?p=236#h5p-29>

## Penelope's Cholesterol

**PES:** Adequate cholesterol as evidenced by lipid labs within target range.

Cholesterol is not a concern for Penelope, so no cholesterol care plan required at this time.

# Physical Activity

During physical activity, blood sugars can decline due to increased glucose disposal and insulin sensitivity. Clients can be encouraged to try to complete:

- 150 minutes of moderate-to vigorous-intensity aerobic exercise each week (e.g. 30 minutes, five days a week).
- Resistance exercises (like lifting weights) two to three times a week.

It may be beneficial to refer clients to a physiotherapist as they may need to be:

- Assessed for conditions that might place them at increased risk for an adverse event associated with certain types of exercise.
- Supervised by an exercise specialist for a certain period of time to ensure safety.



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<https://pressbooks.library.torontomu.ca/dietmods/?p=236#h5p-30>

## Penelope's Physical Activity

**PES:** Inadequate physical activity related to feeling too tired to exercise, as evidenced by < 30 minutes of physical activity per week.

There is no physical activity plan at this time, as Penelope is not currently interested in engaging in more physical activity. She would like to focus on dietary changes first. You don't want to overwhelm her with too many changes at once, so adding in physical activity doesn't need to be part of the care plan at this time. It can be discussed in a follow-up appointment.

## Nutrition Care Plan Summary

### Recommendations

Now that we have gone through all 8 of the key areas to investigate when creating a nutrition care plan, here is a summary of the recommendations. You can refer to this summary when working

with clients living with diabetes in your placement and add to this list as you expand your knowledge in this clinical area of practice.

### Summary of Recommendations

Area of Concern	Recommendations
Hypoglycemia	<ul style="list-style-type: none"> <li>• If BG less than 4.0 mmol/L treat using the 15:15 rule</li> <li>• Adjust dietary patterns to ensure sufficient intake of carbohydrates at meals</li> <li>• Suggest to <b>PCP</b> to adjust medication and/or insulin</li> </ul> <p>(NOTE: without a medical directive, RDs are not permitted to adjust medications)</p>
Hyperglycemia	<ul style="list-style-type: none"> <li>• Adjust dietary patterns</li> <li>• Increase physical activity</li> <li>• Suggest to PCP to adjust medication and/or insulin</li> </ul>
Medication and Insulin Adherence	<ul style="list-style-type: none"> <li>• Check if taking as prescribed</li> <li>• Consult with PCP or Diabetes Nurse Educator to suggest medication changes and/or adjustments</li> </ul>
Carbohydrate Intake	<ul style="list-style-type: none"> <li>• Choose CHO with low <b>GI</b>/high fibre</li> <li>• Consider Carb Counting using Nutrition Facts table</li> </ul>
Macronutrient Distribution	<ul style="list-style-type: none"> <li>• Use Plate Method</li> <li>• Eat CHO at each meal and snack</li> </ul>
Meal Timing	<ul style="list-style-type: none"> <li>• Eat at regular times, no more than 6 hours apart</li> </ul>
Cholesterol	<ul style="list-style-type: none"> <li>• Choose unsaturated fats and foods high in soluble fibre</li> <li>• Limit saturated fat and avoid trans fat</li> <li>• Take cholesterol medications as prescribed</li> </ul>

Physical Activity	<ul style="list-style-type: none"><li>• 150 minutes moderate to vigorous exercise each week</li><li>• Resistance exercise 2-3 times per week</li></ul>
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## PES Statements for Penelope

These are all the nutrition problems that we identified for Penelope using the information we gathered in our assessment and will address in the nutrition care plan.

1. Hypoglycemia related to inconsistent carbohydrate intake, as evidenced by FBG < 4.0mmol/L and feelings of hunger and shaking/trembling before lunch.
2. Hyperglycemia related to excessive carbohydrate intake at dinner, as evidenced by BG > 11 mmol/L 2 hours after dinner and diet history.
3. Inconsistent carbohydrate intake related to food and nutrition knowledge deficit of appropriate amount of dietary carbohydrate, as evidenced by variations in BG levels and diet history.
4. (Adequate meal timing as evidenced by diet hx.)
5. (Adequate cholesterol as evidenced by lipid labs within target range.)
6. Inadequate physical activity related to feeling too tired to exercise, as evidenced by < 30 minutes of physical activity per week.

## Penelope's Nutrition Care Plan

The plan is for Penelope to:

- Treat any future hypoglycemia by using the 15:15 rule.
- Prevent hypoglycemia by including CHO at breakfast, lunch, and dinner; include at HS snack if BG are ~4-5 mmol/L.
- Prevent hyperglycemia by using the Plate Method to create balanced meals, with smaller portions of high fibre CHO.
- Continue to monitor BG 2 times per day using glucometer (FBG in the morning, and BG at HS).

PART 2: PLAN COMPLETE. Pause to reflect on the planning strategies discussed. When you're ready, move on to Part 3: Implement.

# Implement



## Interdisciplinary Team

When implementing your nutrition care plan, you may have to liaise with other members of the care team. You'll want to discuss if you think a client might benefit from increasing their insulin dose, to consider starting a statin if dietary changes have not been effective in managing their cholesterol, or if your client needs a requisition for updated bloodwork. This may include liaising with the endocrinologist, physician or nurse practitioner, diabetes nurse educator, social worker, physiotherapist, and chiroprapist.



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<https://pressbooks.library.torontomu.ca/dietmods/?p=257#h5p-31>

## Liaising with Penelope's Team

In this case, you have consulted with Penelope's physician regarding her current pharmacotherapy and concern over recurrent hypoglycemia with her medication regimen. The physician has considered this and has discontinued Diamicron and will replace it with either an SGLT2 inhibitor or a GLP-1 receptor agonist (depending on which one they can secure compassionate coverage for). You can refer to the [Diabetes Medication Chart](#) for a refresher on these medications.

## Education

When educating clients, try to:

- **Individualize the education as much as possible:** Discuss high-risk topics (like hypoglycemia) first since they are priority, connect the client's goals to your plan, and focus on what they want to learn.
- **Find out if client has had previous education:** Ask the client if any one else has talked to them about their diet and diabetes, and adjust your education accordingly.
- **Focus on a few key messages:** If the client is newly diagnosed or doesn't know much about diabetes, try not to overwhelm

them with too much information during your first couple of interactions. Use visuals, like props and resources, to convey your message whenever possible.

Pause here and think of some key messages you might want to speak to Penelope about when providing education. Continue when you are ready.

## Penelope's Education – Key Messages

Based on your assessment Penelope has a basic understanding of diabetes pathophysiology, but she does not know how to properly treat hypoglycemia. It is important to start your education by reviewing hypoglycemia treatment and then moving on to the key dietary changes that will improve her diabetes management.

Penelope tells you that she gets confused sometimes when trying to plan a meal and thought she was spreading her carbs out throughout the day. She doesn't understand why her BGs are low in the morning and high in the evening. To keep it simple you can focus on these 3 key messages, asking questions throughout:

1. Carbohydrates come from plants (found in grains, legumes, starchy vegetables, fruit, milk, nuts, seeds) and give us energy by being digested into sugar/

glucose for use by our cells. Can Penelope identify the carbs she currently includes in her diet?

2. Hypoglycemia (or low BG) is dangerous because it can lead to fainting and falling. If you feel low, check your BG and follow the 15:15 rule if it is below 4.0 mmol/L.
3. Penelope's breakfast contains mostly protein and fat (from the eggs, bacon, and mayo) with very little carbs – this may have caused a low BG and made her feel shaky and hungry before lunch. Her dinner contained mostly carbs (from the potatoes, corn, and apple juice) which may have caused a high BG reading after dinner. Review the Plate Method with Penelope to portion carbs at each meal by filling her plate with  $\frac{1}{2}$  vegetables,  $\frac{1}{4}$  starch, and  $\frac{1}{4}$  protein.

It's also important to ask your client questions throughout. For example, when helping Penelope understand why her blood sugars were low in the morning, ask Penelope to put her breakfast foods on the plate and see if it is balanced. What is she missing? What could she add next time to make sure she is getting enough carbs in the morning?

Pause here and practice explaining the key messages above in plain language.

## Using analogies

It can also be helpful to use simple analogies. For example, insulin is like a “key” that unlocks the “door” to our cells, allowing sugar in

to provide us energy. In using this analogy to help educate a client about diabetes, you could say:

“Our bodies need insulin in order for sugar to go from our blood into our cells. Insulin is like a ‘key,’ and the cell receptor is like the ‘lock.’ Without insulin, the ‘door’ to our cells cannot be unlocked and sugar cannot get into our cells to provide us energy, so it’s stuck in our blood.”



From [Qimono](#) on Pixabay

## Supporting Change

Ongoing management of a chronic disease can lead to burnout, and making dietary changes may be difficult for some patients. To help support them in making these changes, you may want to try:

- **Motivational interviewing:** collect their story, listen

reflectively, collaborate rather than convince.

- **SMART goal setting:** help to identify barriers to change as part of creating a nutrition care plan with the client.
- **Referral to social worker:** consider referring them to a social worker if they need someone to talk to about coping with the burden of managing a chronic disease.

Pause here and think about some SMART goals that you could set in collaboration with Penelope. Continue when you are ready.

## Penelope's SMART Goals

Here are some SMART goals Penelope could work on based on her diet history and our nutrition care plan. As a part of making the goals SMART, you can discuss with her when she plans on making these changes and come up with ways to support her if or when she encounters barriers.

- Use the 15:15 rule to treat hypoglycemia
- Use the Plate Method to create balanced meals, with high fibre CHO at each snack and meal, such as whole grain bread or brown rice
- Choose a no-sugar beverage instead of apple juice at dinner time
- Include CHO and protein at HS snack if BGs below 7 mmol/L
- Continue to test BGs twice per day (FBG in the

morning and BG at HS) using a glucometer

PART 3: IMPLEMENT COMPLETE. Pause to reflect on the implementation strategies discussed. When you're ready, move on to Part 4: Evaluate.

# Evaluate



## Evaluating the Nutrition Care Plan

After you have implemented the plan, you want to follow-up and evaluate it to see if it has been effective in addressing your nutrition concerns. This can help you to decide on appropriate changes to make to the nutrition care plan moving forward. To evaluate your plan in an outpatient setting, you will need to set up a follow-up appointment or phone call with your client to gather updated information.

In populations with diabetes, the 5 main areas to commonly re-assess in a follow-up are glycemic control, medication and insulin, diet or carb intake, abnormal lipids, and physical activity. These may or may not be a part of the SMART goals you set, so you'll want to ask the client how they are doing in terms of meeting the SMART goals you set together last appointment.

**Questions to Evaluate Nutrition Care Plan Effectiveness**

<b>Common Nutrition Issues</b>	<b>Evaluate Effectiveness of NCP</b>
<b>Glycemic Control</b>	<ul style="list-style-type: none"> <li>• Are their BGs better controlled?</li> <li>• Are they experiencing hypo- or hyperglycemia?</li> <li>• Are they using the 15:15 rule to treat hypoglycemia?</li> </ul>
<b>Medication and Insulin Adherence</b>	<ul style="list-style-type: none"> <li>• Are they taking medication as directed?</li> <li>• Any improvements in glycemic control after a medication change?</li> </ul>
<b>Diet/ Carbohydrate Intake</b>	<ul style="list-style-type: none"> <li>• Have they made the suggested diet changes?</li> <li>• Any barriers to changes?</li> <li>• Are they distributing CHO intake throughout the day?</li> </ul>
<b>Abnormal Lipids</b>	<ul style="list-style-type: none"> <li>• If any improvements to lipid profile?</li> </ul>
<b>Physical Activity</b>	<ul style="list-style-type: none"> <li>• Have they made the suggested changes?</li> <li>• Any barriers to changes?</li> </ul>

## Evaluating Penelope's Nutrition Care Plan

Possible Outcomes of Recommended Changes

Common Nutrition Issues	Evaluate Effectiveness of NCP	Outcome
<b>Glycemic Control</b>	<ul style="list-style-type: none"> <li>• Are her BGs better controlled?</li> <li>• Is she still experiencing hypo- or hyperglycemia?</li> <li>• Is she using the 15:15 rule?</li> </ul>	<ul style="list-style-type: none"> <li>• No longer experiencing shakiness and hunger before lunch</li> <li>• Still sometimes waking up with FBG &lt; 4.0mmol/L</li> </ul>
<b>Medication and Insulin Adherence</b>	–	–
<b>Diet/Carbohydrate Intake</b>	<ul style="list-style-type: none"> <li>• Using the Plate Method to distribute CHO?</li> <li>• Any barriers to changes?</li> </ul>	<ul style="list-style-type: none"> <li>• Using the Plate Method for most meals and snacks</li> <li>• 24-hr recall shows success</li> </ul>
<b>Abnormal Lipids</b>	<ul style="list-style-type: none"> <li>• No concerns at this time</li> </ul>	N/A
<b>Physical Activity</b>	<ul style="list-style-type: none"> <li>• No concerns at this time</li> </ul>	N/A

Since hypoglycemia was a concern for Penelope, you booked a follow-up appointment with her for 5 days later to ensure she is not in danger of injury from frequent hypoglycemic events.

When assessing Penelope's status after the implementation of the nutrition care plan, you want to see if the BG's are better controlled and if she is still experiencing highs or lows. During your follow-up you discover that Penelope has been able to use the Plate Method to plan most meals and snacks, and is including more CHO in her breakfast and lunch, so she is no longer experiencing shakiness and hunger before lunch. Her logbook also shows her blood sugars are around 5-7 in the evening, and her FBG is above 4.

The changes Penelope has made are working well to manage her diabetes and prevent hypoglycemia. Penelope is pleased with these changes and will follow up with you in 3 months.

## The Nutrition Care Process Model

As you use the Nutrition Care Process Model and the learning from this case study as a guide throughout your patient care in practicum, please keep in mind that the process is dynamic, and not step-by-step, as all cases are different. You are encouraged to complete the recommended readings for this module and continue to expand your learning in this clinical area of practice.

PART 4: EVALUATE COMPLETE. Pause to reflect on the evaluation strategies discussed, and review the readings and resources in the following section for your information.

You've now completed the nutrition for Diabetes module. Please consider providing feedback through the embedded form in the next section.

## Acknowledgements

Katie Brunke, RD, CDE, PHEc

Jess Wiles, RD, MHSc(c)

# Feedback Form



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from this version of the text. You can view them online*

here: [https://pressbooks.library.torontomu.ca/  
dietmods/?p=2238](https://pressbooks.library.torontomu.ca/dietmods/?p=2238)

# Reading List

The following is a list of readings and resources to help supplement your learning in this module topic.

## Readings

- CBC The National: [Diabetes in a huge health problem in Canada, and it's on the rise | Health Panel](#) (video, 10:36).
- Dietitians of Canada Practice Blog: [Living with diabetes: Walking a mile in my patients' shoes.](#)
- Canadian Journal of Diabetes: Clinical Practice Guidelines
  - [Chapter 7. Self Management Education and Support](#)
  - [Chapter 8. Targets for Glycemic Control](#)
  - [Chapter 11. Nutrition Therapy](#)
  - [Chapter 13. Pharmacologic Glycemic Management of Type 2 Diabetes in Adults](#)
  - [Chapter 37. Diabetes in Older People](#)

## Additional resources

- [National Indigenous Diabetes Association](#)
- [Public Health Ontario – Diabetes Resources](#)
- [Waterloo Wellington Diabetes – Resources](#)

# HYPERTENSION AND DYSLIPIDEMIA

Welcome to the Nutrition Care for Hypertension and Dyslipidemia section. This will cover the four parts of the Nutrition Care Process (Assess, Plan, Implement, and Evaluate) for patients and clients living with hypertension and dyslipidemia. Please follow along with the case study for David in the coloured boxes to practice. There are also interactive activities throughout the section to check your learning.



Photo by [Mohamed Hassan](#) on [Pixabay](#)

## Learning Outcomes

By the end of this section, you will be able to:

1. Identify where to gather clinical, anthropometric, biochemical, and dietary data necessary to complete a nutrition assessment for a client living with hypertension or dyslipidemia.
2. Interpret biochemical values and diagnostic test values, including BP readings, TC, HDL, LDL, and TG.
3. Analyze the 9 areas of nutrition-related concern (medication adherence, dietary patterns, sodium intake, saturated and trans fat intake, fibre intake, physical activity, smoking, alcohol intake, and stress) in clients living with hypertension or dyslipidemia and form PES statements for each.
4. Determine likely causes for high blood pressure, cholesterol, and triglyceride levels and recommend methods to treat and prevent each through diet and/or lifestyle changes.
5. Recognize dietary strategies, such as DASH or Mediterranean Diet, to help reduce blood pressure, cholesterol and triglyceride levels.
6. Understand the roles of the interdisciplinary team, including the physician, nurse practitioner, social worker, physiotherapist, cardiologist, or other vascular specialists.
7. Recognize effective strategies, such as motivational interviewing (MI) and **SMART goal** setting, to provide education and support behaviour change.
8. Evaluate the nutrition care plan using assessment data relevant to the client nutrition concerns, including biochemical data, medication adherence, diet intake, physical activity, and other lifestyle factors.

# Background

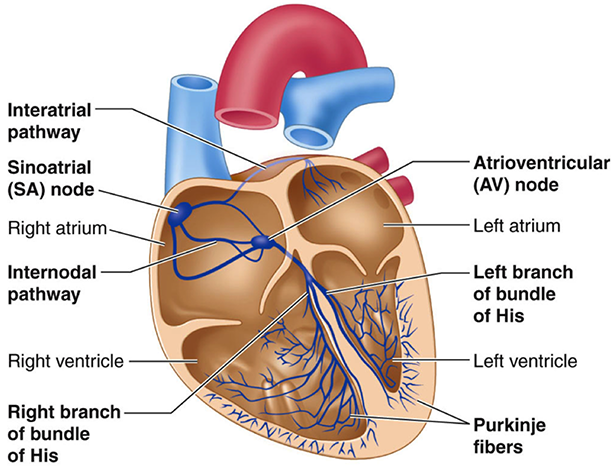
## The Cardiovascular System

The role of the cardiovascular system is to:

- regulate blood flow to tissues in the body
- deliver oxygenated blood and nutrients
- retrieve waste products
- regulate the temperature of the body
- transport hormones
- maintain fluid volume
- regulate pH
- facilitate gas exchange of oxygen and carbon dioxide

## Electrical Conduction of the Heart

The diagram of the heart below provides an overview of the different parts of the heart, and how blood flows through it.



“Electrical conduction system of the heart: The figure illustrates the different electrical nodes and muscle fibers that play a role in the electrical conduction system. It also represents the NSR pathway.” Full text description is below. [\(Ganesan et al., 2016\)](#)



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<https://pressbooks.library.torontomu.ca/dietmods/?p=270#h5p-68>

## Cardiovascular Disease

Cardiovascular Disease (CVD) is a group of disorders involving the heart and blood vessels.

Common forms of CVD include:

- Coronary artery disease (**CAD**)
- Hypertension (HTN)
- Heart failure
- Ischemic heart disease or coronary heart disease (**CHD**)
- Peripheral arterial disease (**PAD**)
- Dyslipidemia

In this section we will focus on **Hypertension** and **Dyslipidemia**.

## Hypertension

Hypertension is a medical condition in which the blood pressure in the arteries is persistently elevated.

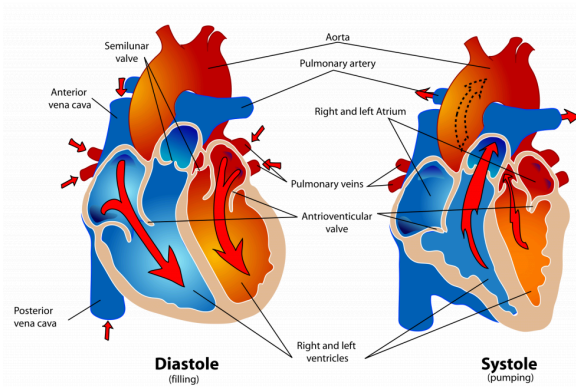
The cardiac cycle consists of two phases: systolic and diastolic. Systolic blood pressure measurement is the force exerted on the walls of blood vessels during contraction (when the heart beats). Diastolic blood pressure measurement is the force exerted during relaxation (resting between beats).

Blood Pressure (BP) is regulated by:

- Cardiac output
- Sympathetic nervous system
- Renin angiotensin aldosterone system (**RAAS**)
- Renal function

## Diastole and Systole

It's important to understand the various physiological mechanisms involved in blood pressure regulation as cardiac medications act on those systems.



Human heart shown during systole and diastole. Full text description is below.  
 Source: [LadyofHats via Wikimedia Commons.](#)



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<https://pressbooks.library.torontomu.ca/dietmods/?p=270#h5p-69>

## Dyslipidemia

Dyslipidemia is an abnormal amount of lipids in the blood, which is confirmed using a blood test.

The main lipids involved include:

- Low-density lipoprotein (LDL)
- High-density lipoprotein (HDL)
- Triglycerides (TG)

Dyslipidemia can also be described as:

- Hyperlipidemia: abnormally high levels of TC, LDL-C or TG
- Hypercholesterolemia: elevated TC and/or LDL-C

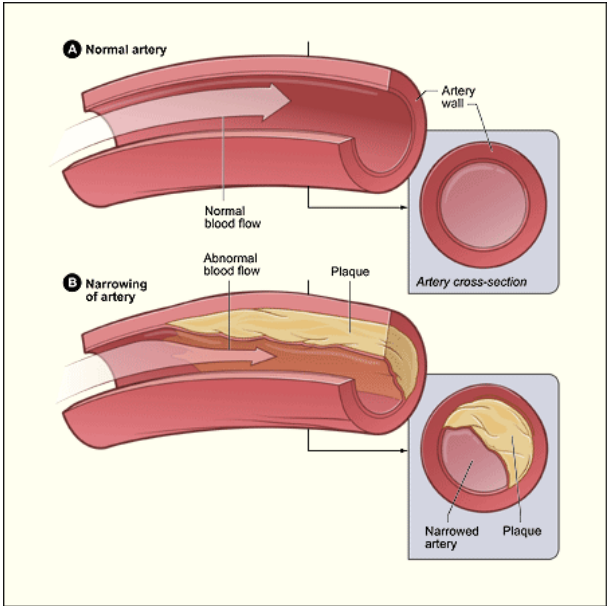
These can lead to CVD as high LDL-C levels are associated with coronary artery disease (CAD) and peripheral artery disease (PAD).

A diagnosis of dyslipidemia can also mean that HDL cholesterol levels are too low.

## Atherosclerosis and Coronary Artery Disease

Atherosclerosis refers to the progressive thickening of blood vessels due to an accumulation of plaque. Plaque is built of fatty deposits, fibrous connective tissue and smooth muscle cells, and may lead to blocked blood flow to the:

- Coronary arteries (CAD)
- Heart (myocardial infarction)
- Brain (stroke)
- Legs (PAD)



Source:  
[National Heart, Lung, and Blood Institute](#)



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<https://pressbooks.library.torontomu.ca/dietmods/?p=270#h5p-73>

Background complete! Feel free to review any resources and move to the next section, “Assess”, when you are ready.

# Assess



## Setting the Agenda

Before you begin your assessment or any interaction with a client, make sure to:

1. Start out by greeting them and introducing yourself.
2. Describe the role of a Registered Dietitian in terms of their health care.
3. Invite them to the conversation to build rapport.
4. Set the agenda for the appointment by asking about what brings them in and how you can help with the management of their blood pressure or cholesterol.



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<https://pressbooks.library.torontomu.ca/dietmods/?p=94#h5p-19>

## Case Study: Meet David



*David  
Krulicki,  
your client*

You are a Registered Dietitian (RD) at a Family Health Team. The client you are assessing is a 45 year old male named David Krulicki with hypertension, dyslipidemia, and depression. He is a plumber and lives with his wife Martha, who is responsible for grocery shopping and cooking. He has had financial stressors lately, though does not experience food insecurity.

David has agreed to see the RD because would like to implement lifestyle changes and avoid increasing his medications.

# Gathering Data for an Assessment

When gathering data for your assessment make sure to collect information on the patient's:

- Clinical Data (both Medical History and Social History)
- Anthropometric Data
- Biochemical Data
- Dietary Data

## Clinical Data

### Medical History

When gathering clinical data, consider:

- **Diagnosis:** Have they received a diagnosis from their doctor? Do they have one or more CVD-related diagnoses (hypertension, dyslipidemia)? Are they at risk of developing CVD? Duration of Diagnosis?
- **Patient Medical History:** Do they have other medical conditions (diabetes, chronic kidney disease, depression)?
- **Family History:** Did members of their family have CVD or other medical conditions?
- **Management:** Do they regularly see any other doctors or specialists?
- **Medications:** Are they on any drug therapies for **HTN** or dyslipidemia? Keep medications in mind when assessing any possible drug nutrient interactions, for example, with many heart medications patients can't drink grapefruit juice.

## David's Medical History

- **Diagnosis:** Hypertension (1 year since Diagnosis) and dyslipidemia (5 years since Diagnosis)
- **Patient Medical History:** Depression
- **Medications:**
  - Losartan and hydrochlorothiazide (Hyzaar) 50 mg + 12.5 mg **BID**
  - Amlodipine (Norvasc) 10mg **OD**, switched from being on Ramipril (Altace) 2 months ago
  - Atorvastatin (Lipitor) 80 mg OD
  - Fluoxetine (Prozac) 20 mg OD
  - 1000 IU vitamin D OD
  - His primary care provider (PCP) suggested an additional medication to manage his dyslipidemia
  - He has come to see you because he does not want to take any additional medications and to try to control it with lifestyle changes

## Cardiac Medication Classification

When gathering medications as part of the nutrition assessment, refer to this [Cardiac Medications List \(PDF\)](#). It summarizes the various classes of medications for HTN and dyslipidemia, and also

details their side effects, nutrition interactions (for example, many HTN medications interact with grapefruit and natural liquorice), and the parts of the body they act on to help control blood pressure and lipids. Some common types of drug classes for HTN and dyslipidemia are listed below.

**Common types of drug classes for HTN and dyslipidemia**

Common medications for HTN	Common medications for Dyslipidemia
<ul style="list-style-type: none"> <li>• Angiotensin Converting Enzyme (ACE) Inhibitors</li> <li>• Angiotensin II Receptor Blockers (ARBs)</li> <li>• Calcium Channel Blockers (CCBs)</li> <li>• Diuretics</li> <li>• Beta-Blockers</li> <li>• Alpha blockers</li> <li>• Alpha-2 Receptor Agonists</li> </ul>	<ul style="list-style-type: none"> <li>• Statins</li> <li>• Bile Acid Sequestrants</li> <li>• Cholesterol Absorption Inhibitors</li> <li>• Fibrates</li> <li>• Lipoprotein Synthesis Inhibitor</li> <li>• Dietary Supplements</li> </ul>

A special note on diuretics: it's important to differentiate between potassium sparing and non-potassium sparing as they greatly affect electrolytes.

## Social History

It's also important to gather information on the client's social history, which will help you to tailor your nutrition plan later on.

When gathering social history, consider:

- **Housing:** What is their living situation? Do they live with others/have a support system?
- **Income:** Are they currently working? What is their main source of income? Do they have medical coverage?
- **Substance use:** Smoking? Alcohol use? Any other substances?

- **Food security:** Has anyone in their household gone without food in the past month because they couldn't afford it?
- **Physical activity:** Do they exercise? Do they have an injury or live in an unsafe area making it difficult to get outside to exercise? Do they have access to exercise facilities or equipment?

## David's Social History

- **Housing:** Lives with wife
- **Income:** Works as a plumber
- **Substance use:**
  - Smoker. Has increased his smoking lately due to stress.
  - Drinks 1-2 alcoholic beverages a night (beer, sometimes wine)
- **Food security**
  - Does not indicate any concerns with the ability to purchase foods
  - During this conversation, tells you his wife is responsible for grocery shopping and preparing meals
- **Physical activity**

- Has a lower back injury
- Used to walk with his wife for 15-30 minutes every night. Stopped recently.
- Expresses to you that he enjoys exercise but it causes pain

## Anthropometric Data

When gathering anthropometric data from the client, consider:

- **Weight:** Current body weight in kg. If the client is open to having this taken.
- **Weight History:** Do they have an interest in weight loss? Have they tried to lose weight before? Has their weight recently fluctuated? What was their highest and lowest adult body weight?
- **Waist Circumference:** Current waist circumference in cm. If the client is open to having this taken, it can be a valuable screening measurement.
- **Height:** Current height in cm.
- **BMI:** Body Mass Index. Always consider muscle mass when using this tool.
- **Physical Assessment:** What is their muscle tone? Any muscle wasting?

It's important to ask if the client is comfortable having these measurements taken as this may trigger stress for some clients. If the client states that weight loss is a goal for them, it can be helpful to know:

- Why that goal is important for them
- If they have tried to lose weight before
- Any diets they have tried in the past
- How their weight has fluctuated over the years

## David's Anthropometric Data

- **Weight** = 80 kg
- **Height** = 175.5 cm
- **BMI** = 26 kg/m<sup>2</sup>
- **Weight History** = David reports his weight has been mostly stable over the past few years, however he has been gaining weight quickly over the past few months. The physician reports this as 15 pounds of weight gain in the past 6 months.

# Biochemical Data

## Blood pressure ranges

Blood pressure values used to diagnose HTN, according to [American Heart Association guidelines](#)

Blood Pressure Category	SYSTOLIC mm Hg (upper number)	and/or	DIASTOLIC mm Hg (lower number)
<b>Normal</b>	Less than 120	and	Less than 80
<b>Elevated</b>	120 - 129	and	Less than 80
<b>High Blood Pressure (Hypertension) STAGE 1</b>	130 - 139	or	80 - 89
<b>High Blood Pressure (Hypertension) STAGE 2</b>	140 or higher	or	90 or higher
<b>Hypertensive Crisis (consult your doctor immediately)</b>	Higher than 180	and/or	Higher than 120

For patients with high blood pressure, measurements should be taken and used in forming a treatment plan to reduce their BP to the targets in the table below. Note that target ranges differ for clients with HTN, DM, and by level of CV risk. Target ranges can also vary based on the physician's assessment of client needs.

## Blood pressure targets

BP thresholds and treatment targets, according to [Hypertension Canada 2020 guidelines \(PDF\)](#)

*\*BP treatment threshold and target based on automatic office blood pressure readings (AOBP)*

*\*\*BP treatment threshold and target based on non-AOBP measurements performed in office.*

Patient Population	BP threshold for initiation of antihypertensive therapy		BP treatment target	
	SBP mmHg	DBP mmHg	SBP mmHg	DBP mmHg
<b>Hypertension Canada High-Risk Patient*</b>	≥ 130	N/A	< 120	N/A
<b>Diabetes mellitus**</b>	≥ 130	≥ 80	< 130	< 80
<b>Moderate-to-High Risk (CV risk factors)**</b>	≥ 140	≥ 90	< 140	< 90
<b>Low Risk (no CV risk factors)**</b>	≥ 160	≥ 100	< 140	< 90

## Lipid tests

You also want to collect and assess any blood work they've done for lipids, including total cholesterol, HDL, LDL, and non-HDL cholesterol, and triglycerides.

For more information, read the [2022 Canadian Cardiovascular Society Dyslipidemia Guidelines \(PDF\)](#)

### Normal and target ranges for lab tests

Lab Test	Definition	Normal	Target
<b>TC</b>	Total cholesterol: amount of total cholesterol in blood	< 5.2 mmol/L	≤ 4.0 mmol/L
<b>HDL Chol</b>	High density lipoprotein: “good” cholesterol absorbs cholesterol and carries it back to liver	≥ 1.0 mmol/L	≥ 1.0 mmol/L
<b>LDL Chol</b>	Low density lipoprotein: “bad” cholesterol leading to plaque build up resulting in heart disease	< 3.5 mmol/L	≤ 2.0 mmol/L
<b>Non-HDL Chol</b>	Total cholesterol – HDL = Non-HDL Chol Includes <b>VLDL, IDL, Lp(a), LDL</b> , etc.	< 4.0 mmol/L	≤ 2.6 mmol/L
<b>TG</b>	Triglycerides: fat found in blood used for energy; excess fat storage	≤ 1.7 mmol/L	≤ 1.7 mmol/L

## David's Biochemical Data

Often individuals diagnosed with hypertension will measure BP at home. Your client may provide you with a verbal or written list of previous BP readings. This provides you with more information, compared to the BP reading you may perform in your office.

Here are the BP measurements for David. Use the BP target values provided above to determine if David falls within normal range or is above target. This information will be used when planning the nutrition care plan in the next section.

**David's BP measurements**

<b>Measurement Date</b>	<b>BP Result</b>
May 1	139/89
May 2	145/92
May 3	142/91
May 4	151/96
May 5	141/90

Although David does not have diabetes, it is important to consider that his hypertension and dyslipidemia puts him at risk for the development of diabetes. If you have the laboratory data available you should check in on this. Determine which lab values are within target or are elevated.

### David's lab test results, compared with target ranges

Lab Test	Lab Result	Target Range
A1C	5.5%	≤ 6.0%
TC	6.2 mmol/L	≤ 4.0 mmol/L
LDL	4.2 mmol/L	≤ 2.0 mmol/L
HDL	0.8 mmol/L	≥ 1.0 mmol/L
TG	4.0 mmol/L	≤ 1.7 mmol/L

In David's case, his A1C is normal. If it was not, you should talk to his **PCP**.

## Dietary Data

When gathering dietary data, you should consider the client's:

- **Diet History:** 24-hour recall or 3-day food record. Have they tried any diets in the past? Are they following the Dietary Approach to Stop Hypertension (DASH) diet or the Mediterranean Eating Pattern?
- **Eating behaviours/patterns:** How many meals per day and how many hours between their meals and snacks? Eating at home or eating out?
- **Cardiac dietary areas of concern:** Intake of fibre, saturated fat, unsaturated fat, sodium and other electrolytes
- **Food skills and access:** Do they have access to a kitchen? Do they have access to a grocery store? Do they get groceries and/or cook at home, or does someone else do this for them? Previous nutrition education? What do they know about

managing their blood pressure or cholesterol with diet choice

## Dietary Strategies

### The Mediterranean Eating Pattern

The American Heart Association guidelines on lifestyle management to reduce CVD risk recommends following a dietary pattern that emphasizes intake of vegetables, fruits, and whole grains; includes low-fat dairy products, poultry, fish, legumes, non-tropical vegetable oils, and nuts; and limits intake of sweets, sugar-sweetened beverages, and red meats. Individuals can achieve this well-balanced dietary pattern by following the Mediterranean diet, Canada's Food Guide (CFG), or the **DASH** diet and adapt it with help from an RD to ensure it suits their energy and protein requirements, personal and cultural food preferences, and meets any nutrition therapy needs for other medical conditions, like diabetes. Following a dietary pattern like this can help clients with HTN and dyslipidemia reduce their CVD risk.

The Mediterranean Diet is:

- Low in saturated fat
- Very low in trans fat
- Rich in unsaturated fat
- Rich in starch and fibre
- Rich in nutrients and phytochemicals that support good health
- Plant-based and limited red meats

# DASH Eating Pattern

The Dietary Approach to Stop Hypertension (DASH) diet has been shown to help manage and even prevent high blood pressure. Similar to the Mediterranean diet and **CFG**, it emphasizes whole grains, vegetables and fruits, low-fat dairy products, lean meats, and is low in saturated and trans fats. It also works on a serving size system, so keep in mind that clients using this will have to be educated on serving sizes.

For more details, read the [Vermont Department of Health's DASH Eating Plan resource \(PDF\)](#).

**DASH Eating Plan**

<b>Food Group</b>	<b>Daily Servings</b>	<b>Serving Sizes (1 serving is equivalent to)</b>
<b>Grains</b>	7-8	1 slice of bread 1 ounce of dry cereal ½ cup of cooked rice, pasta, cereal
<b>Vegetables</b>	4-5	1 cup raw leafy vegetables ½ cup cut up raw or cooked vegetables
<b>Fruit</b>	4-5	1 medium piece of fruit ¼ cup dried fruit ½ cup fresh, frozen or canned fruit
<b>Fat-free or low-fat dairy products</b>	2-3	1 cup yogurt 1 ½ ounce cheese
<b>Lean meats, poultry, fish</b>	2 or fewer	3-ounce cooked meats, poultry of fish
<b>Nuts, seeds, and legumes</b>	4-5 per week	1 tbsp of peanut butter or seeds ½ cup cooked legumes
<b>Fats and oils</b>	2-3	1 tsp margarine (non-hydrogenated) 1 tbsp mayonnaise 1 tsp vegetable oil
<b>Sweets</b>	5 per week	½ ounce jelly beans

# Dietary Recommendations

## Sodium Recommendations

- To decrease BP, consider reducing sodium intake toward 2000 mg (5 g of salt or 87 mmol of sodium) per day (Grade A).
- Although sodium recommendations are more liberal, compared to healthy people, the majority of people with hypertension consume too much sodium, > 3000 mg/day.

For more information, read [Hypertension Canada's 2020 Comprehensive Guidelines for Adults and Children \(PDF\)](#).

## Fat Intake Recommendations

Reviewing fat intake and the different types of fat in the diet is key when working with a client who has high cholesterol or dyslipidemia, as intake of food with saturated and trans fat has a greater impact on blood cholesterol levels than intake of dietary cholesterol. Here are the recommendations surrounding intake of the different types of fat, like trans fat, saturated fat, and unsaturated fat, particularly omega 3, 6, and 9.

### Fat intake recommendations, by fat type

Type of Fat	Recommendation	Foods That Contain The Fat
<b>Unsaturated Fats</b>	Include most often (2-3 tbsps a day)	<ul style="list-style-type: none"> <li>• Fish, seafood</li> <li>• Olives, avocado, mayonnaise, and non-hydrogenated margarines (made with the oils below)</li> <li>• Oils: olive, canola, peanut and sesame</li> <li>• Nuts: almonds, cashews, chestnuts, peanuts, hazelnuts, pecans, pistachios and their butters</li> </ul>
<b>Omega 3</b>	Include more often (2-3 servings of fish a week)	<ul style="list-style-type: none"> <li>• Fatty fish (mackerel, sardines, salmon, and trout), seafood</li> <li>• Oils: canola, flax, hemp seed.</li> <li>• Nuts and seeds: chia, walnuts, pumpkin seeds, crushed flax and hemp seed.</li> <li>• Soybean products, non-hydrogenated margarines (made with above oils)</li> </ul>
<b>Omega 6 &amp; 9</b>	Include in small amounts	<ul style="list-style-type: none"> <li>• Oils: grapeseed, corn, safflower, sunflower, soybean, cottonseed</li> <li>• Sunflower seeds, wheat germ, non-hydrogenated margarines (made with the oils listed above)</li> </ul>
<b>Saturated Fats</b>	Limit (<5-10% of total daily fat intake)	<ul style="list-style-type: none"> <li>• Meat (fresh or processed), dark poultry meat, poultry skin</li> <li>• High fat dairy products, egg yolk</li> <li>• Bakery products, butter, lard, bakery products</li> <li>• Tropical oils: palm oil, palm kernel oil, coconut oil</li> </ul>

<b>Trans Fat</b>	Avoid	<ul style="list-style-type: none"><li>• Partially hydrogenated vegetable oil and shortening</li><li>• Deep fried foods and fast foods</li><li>• Some packaged foods: cookies, crackers, potato chips, baked goods and candy bars</li></ul>
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## Fibre Intake Recommendations

Reviewing fibre intake and the different types of fibre in the diet is key when working with a client who has high cholesterol or dyslipidemia, as intake of soluble fibre can reduce cholesterol by inhibiting cholesterol and bile absorption in the small intestine. Women need at least 25 grams of fibre per day, and men need at least 38 grams of fibre per day.

### Benefits and sources of fibre, by fibre type

Fibre Type	Benefits	Food Sources
<b>Soluble Fibre</b>	Can reduce cholesterol by inhibiting cholesterol and bile absorption in the small intestine.	<ul style="list-style-type: none"> <li>• Oats</li> <li>• Barley</li> <li>• Legumes</li> <li>• Fruit</li> </ul>
<b>Insoluble Fibre</b>	Provides fecal bulk to help promote regular bowel movements. Can prevent colon cancer and diverticular disease and increases satiety.	<ul style="list-style-type: none"> <li>• Vegetables and fruit</li> <li>• Legumes</li> <li>• Nuts and seeds</li> <li>• Whole grains (brown rice, quinoa)</li> <li>• Whole wheat products (pasta, cereal, bread, crackers)</li> </ul>

## David's Dietary Data

### Food access and food skills:

- His wife does the grocery shopping and cooking.
- Eats out twice a week at fast food or dine-in restaurants. Mostly for lunch.
- He reports that his meals are consistent and the diet recall represents his typical patterns.

- He reports having no prior nutrition education.

**Diet History (24-hour recall):**

**David's 24-hour diet recall**

<b>Meal</b>	<b>David's diet recall</b>
<b>Breakfast 9 am</b>	2 eggs, 2 pieces bacon, 1 piece of white bread, 15 mL butter on bread, 1 coffee with 2 milk (2%)
<b>Lunch 1-2 pm</b>	Turkey sandwich (2 slices of white bread, 2 slices of deli turkey, tbsp of mayo, tbsp of mustard, 2 slices of cheddar cheese, lettuce, and tomato) with 1 cup of soup (canned tomato or mushroom), 500 mL of water
<b>Dinner 5:30-6:30 pm</b>	6 ounces of meat (beef), 1 cup mashed potatoes, 1 cup of salad, 500 mL of water
<b>HS snack</b>	1 bowl of cereal (cheerios) with 1 cup of 2% milk and a small bag of chips with 1-2 beers

## PES Statements for Dietary Data

### Common PES Statement Terminology

As you interpret the dietary data from the assessment, you can form Problem, Etiology, Symptoms (PES) statements or nutrition diagnoses that help identify nutrition concerns that need to be addressed in your plan. If you are not familiar with how to write a PES statement please review this [resource from the Academy of Nutrition and Dietetics](#). Here are some common nutrition problems that patients with HTN and dyslipidemia may experience:

- Excessive saturated fat intake
- Less than optimal intake of types of fats (specify)
- Inappropriate intake of fats
- Inadequate vegetable and fruit consumption
- Inadequate fibre intake
- Excessive sodium intake
- Imbalance of nutrients
- Physical inactivity
- Altered nutrition-related laboratory values (specify)
- Food- and nutrition-related knowledge deficit
- Impaired ability to prepare food/meals
- Not ready for diet/lifestyle change

## Guiding Questions

Use the dietary assessment data you have collected from David so far to form a PES statement for his intake of sodium, fat, fibre, and DASH diet recommendations.

You can use the questions below to guide you:

- Is David meeting the DASH Diet recommended amount of whole grains, vegetables and fruit, dairy products, and lean meats and poultry in his diet recall?
- Is he exceeding the daily recommended amount of sodium?
- Is he consuming excess saturated fat and is his intake of unsaturated fats sources adequate?
- Is his fibre intake adequate?
- Are there any potential drug nutrient interactions?



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## PES Statements for David's Dietary Intake

These are some examples of PES statements that you may have formed for David based on his intake.

For example, if we count his fruit and vegetable intake, it looks like he is only getting about 2-3 servings. Therefore, he has an imbalance of nutrients related to food and nutrition knowledge deficit of healthy dietary patterns as evidenced by not meeting DASH diet recommendations for vegetables and fruit. He also has excessive sodium intake, excessive intake of saturated and trans fats, and inadequate intake of fibre.

These PES statements will be used later on in the section when forming the nutrition care plan:

1. Imbalance of nutrients related to food and nutrition knowledge deficit of healthy dietary patterns as

evidenced by not meeting DASH diet recommendations for whole grains, vegetables and fruit, dairy products, lean meats, poultry, fish, fats, and oils.

2. Excessive sodium intake related to a knowledge deficit of sodium sources and importance of sodium reduction for blood pressure control as evidenced by high intake of processed foods such as bacon, deli meat, canned soup, etc.
3. Excessive intake of saturated and trans fat related to a lack of food preparation knowledge and skills as evidenced by high intake of processed meat, red meat, and chips.
4. Inadequate intake of fibre related to a knowledge deficit of food sources of fibre as evidenced by low intake of vegetables and whole grains.

## Simulation Activity: David



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PART 1: ASSESS COMPLETE. Pause to reflect on the assessment strategies discussed. When you're ready, move on to Part 2: Plan.

# Plan



## Creating a Nutrition Care Plan

We are going to use the data we collected in the Assess stage to form a nutrition care plan for HTN and dyslipidemia, considering each of these 9 key areas:

- Medication Adherence
- Dietary Patterns – Mediterranean Diet & DASH Diet
- Sodium Intake
- Saturated and Trans Fat Intake
- Fibre Intake
- Physical Activity
- Smoking
- Alcohol Intake
- Stress

## Medication Adherence

It is always important to check in with the client on medication adherence. You can ask a few simple questions:

- Are they taking their medication at the times prescribed?
- Do they always take their medication? If not, how frequently

- do they miss taking a dose? Why are they not taking it?
- Does the client notice any side effects when taking the medication (this may be a reason for other factors reported to you that may influence your plan of care – i.e. nausea, diarrhea, lack of appetite)?

Liaise with **PCP** regarding medication education or changes, if needed (i.e. client reports a concern or symptom not yet documented).

## David's Medications

David is taking the listed medications as directed. David tells you that he has been experiencing constipation. This has recently become more frequent and is beginning to bother him.

- David recently switched to a new BP medication, Amlodipine (Norvasc) 10mg, which can cause constipation
- In this situation, you could liaise with PCP and consider a different blood pressure medication.
- You may also suggest a fibre supplement, like Metamucil, that can help relieve constipation.

# Dietary Patterns – DASH Diet

Revisiting our dietary assessment, we can use the DASH dietary pattern to help us form our nutrition care plan.

For more information, read:

- [“Effects on Blood Pressure of Reduced Dietary Sodium and the Dietary Approaches to Stop Hypertension \(DASH\) Diet,”](#) a journal article from The New England Journal of Medicine.
- [Vermont Department of Health’s DASH Eating Plan resource \(PDF\).](#)

**DASH Eating Plan**

<b>Food Group</b>	<b>Daily Servings</b>	<b>Serving Sizes (1 serving is equivalent to)</b>
<b>Grains</b>	7-8	1 slice of bread 1 ounce of dry cereal ½ cup of cooked rice, pasta, cereal
<b>Vegetables</b>	4-5	1 cup raw leafy vegetables ½ cup cut up raw or cooked vegetables
<b>Fruit</b>	4-5	1 medium piece of fruit ¼ cup dried fruit ½ cup fresh, frozen or canned fruit
<b>Fat-free or low-fat dairy products</b>	2-3	1 cup yogurt 1 ½ ounce cheese
<b>Lean meats, poultry, fish</b>	2 or fewer	3-ounce cooked meats, poultry or fish
<b>Nuts, seeds, and legumes</b>	4-5 per week	1 tbsp of peanut butter or seeds ½ cup cooked legumes
<b>Fats and oils</b>	2-3	1 tsp margarine (non-hydrogenated) 1 tbsp mayonnaise 1 tsp vegetable oil
<b>Sweets</b>	5 per week	½ ounce jelly beans

## David's Dietary Pattern

**PES:** Imbalance of nutrients related to food and nutrition knowledge deficit of dietary patterns as evidenced by not meeting DASH diet recommendations for whole grains, vegetables and fruit, dairy products, lean meats, poultry, fish, fats, and oils.

As outlined in our assessment, David is not currently following the DASH diet as a method to help control his BP and lipids. Providing an overview of the importance of balanced meals and snacks using the DASH diet, you can target areas beneficial for controlling blood pressure and reducing cholesterol. It's important that David has a basic understanding of healthy dietary habits and is able to understand it in a practical way.

We will use principles from the DASH diet to create a nutrition care plan for David. As you do this, keep in mind:

- Small goals lead to big achievements and motivate the client to pursue a goal.
- You do not have to change the entire diet in one appointment. This can be done in a step-wise

manner, which is more likely to result in a successful outcome.

- Always ask the client for their opinion when making suggestions, it is important that they are a part of the process.

## Sodium Intake

Some strategies from the DASH diet to consider as part of the plan to reduce sodium in clients with HTN include trying to:

- Choose vegetables and fruits more often (fresh or frozen without added salt).
- Limit processed, smoked, and cured foods.
- Avoid using salt at the table and reduce salt added during cooking.
- Avoid seasonings that contain the word 'salt' or 'sodium' (such as garlic salt, celery salt, or monosodium glutamate [MSG]).
- Flavour foods with herbs, spices, garlic, onion, lemon, or vinegars.
- Limit frozen convenience foods and fast food restaurant meals.
- Use the Nutrition Facts table to determine sodium amounts: try to avoid foods with more than 300 mg of sodium per serving or % DV < 5
- Read food labels to determine sodium amounts: look for 'unsalted' or 'no added salt' or 'low in sodium' or 'salt-free' items. Note that 'sodium-reduced' does not necessarily mean low sodium.

For more information, read Heart and Stroke Foundation of Canada's "[Managing your blood pressure](#)" (PDF) resource.



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## David's Sodium Intake

**PES:** Excessive sodium intake related to a knowledge deficit of sodium sources and importance of sodium reduction for blood pressure control as evidenced by high intake of processed foods such as bacon, deli meat, canned soup, etc.

As we noted during the assessment (i.e. medical History, BP readings, dietary recall), David has HTN and a high

intake of sodium. To help David control his blood pressure, here are a few suggestions to reduce his sodium intake.

**Suggestions for David's diet to reduce sodium intake, by meal.**  
**[\*] indicates foods in diet recall most relevant to sodium intake**

Meal	David's diet recall	Suggestions to reduce sodium
<b>Breakfast</b>	2 eggs, 2 pieces bacon*, 1 piece of white bread, 15 mL butter on bread, 1 coffee with 2 milk (2%)	<ul style="list-style-type: none"> <li>• Tell David that processed meats (such as bacon) are very high in sodium</li> <li>• Reduce the consumption of bacon towards having it as a "treat" once a week</li> </ul>
<b>Lunch</b>	Turkey sandwich (2 slices of whole grain bread, 2 slices of deli turkey*, tbs of mayo*, tbs of mustard*, 2 slices of cheddar cheese, lettuce, and tomato) with 1 cup of soup (canned tomato or mushroom)*, 500 mL of water	<ul style="list-style-type: none"> <li>• Reinforce that processed meats (such as turkey slices) are high in sodium</li> <li>• Substitute turkey slices for cooked chicken, turkey, or low-sodium canned tuna</li> <li>• Reduce condiment serving size, or substitute for hummus</li> <li>• Substitute the cheddar cheese with a low-fat or reduced fat alternative</li> <li>• Tell David to seek low-sodium canned soup options using the nutrition facts table</li> </ul>
<b>Dinner</b>	6 ounces of meat (beef), 1 cup mashed potatoes*, 1 cup of salad, 500 mL of water	<ul style="list-style-type: none"> <li>• Ask David if mashed potatoes are pre-made. If so...</li> <li>• Substitute pre-made mashed potatoes for quinoa, whole grain pasta or brown rice (as the starch component) at every other dinner</li> </ul>

<b>HS snack</b>	1 bowl of cereal (cheerios) with 1 cup of 2% milk and a small bag of chips* with 1-2 beers	<ul style="list-style-type: none"> <li>• Reinforce the importance of avoiding packaged foods</li> <li>• Treat chips as a “treat”</li> <li>• Substitute chips for air-popped popcorn</li> </ul>
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For David, the key message here is to reduce the amount of processed and packaged foods.

## Saturated and Trans Fat Intake

To reduce saturated and trans fats, clients can be encouraged to try to:

- Choose unsaturated fats (olive oil, canola oil, soft non-hydrogenated margarine) more often than saturated fats (butter, cream) when cooking.
- Include fatty fish in a meal two to three times a week.
- Use skim or 1% milk rather than 2% or 3.25% milk or cream.
- Choose lean meat and poultry and trim off the fat and skin before cooking.
- Add nuts and seeds to salads and use nut butters as spreads.
- Limit fast food and processed food that is high in trans fats.

For more information, read Heart and Stroke Foundation of Canada’s [“How to Manage Your Cholesterol” \(PDF\)](#) resource.



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## David's Saturated and Trans Fat Intake

**PES:** Excessive intake of saturated and trans fat related to a lack of food preparation knowledge and skills as evidenced by high intake of processed meat, butter, red meat, and chips.

As we noted during the assessment (i.e. History data, elevated lipid levels, dietary recall), David has dyslipidemia and high intake of saturated and trans fat. To help David control his dyslipidemia and reduce his LDL, here are a few suggestions to reduce his intake of saturated and trans fat.

**Suggestions for David's diet to reduce intake of saturated and trans fat, by meal.**

**[\*] indicates foods in diet recall most relevant to saturated and trans fat**

<b>Meal</b>	<b>David's diet recall</b>	<b>Suggestions to reduce saturated and trans fat</b>
<b>Breakfast</b>	2 eggs, 2 pieces bacon*, 1 piece of white bread, 15 mL butter on bread*, 1 coffee with 2 milk (2%)	<ul style="list-style-type: none"> <li>Tell David that bacon is a significant source of both sodium and saturated fat</li> <li>Substitute butter for a nut-based butter (e.g. peanut, almond, etc.), as these are sources of unsaturated fats</li> </ul>
<b>Lunch</b>	Turkey sandwich (2 slices of whole grain bread, 2 slices of deli turkey, tbsp of mayo, tbsp of mustard, 2 slices of cheddar cheese, lettuce, and tomato) with 1 cup of soup (canned tomato or mushroom), 500 mL of water	<ul style="list-style-type: none"> <li>Substitute deli turkey with real turkey or other meats for the sandwich</li> <li>Reduce the cheddar cheese to 1 slice or skip it</li> </ul>
<b>Dinner</b>	6 ounces of meat (beef)*, 1 cup mashed potatoes, 1 cup of salad, 500 mL of water	<ul style="list-style-type: none"> <li>Tell David it is OK to have a source of meat with dinner, but beef is a higher source of saturated fat than other types of meat</li> <li>Substitute beef for lean meats (e.g. chicken) or fatty fish (e.g. salmon) as his source of protein</li> </ul>

<b>HS snack</b>	1 bowl of cereal (cheerios) with 1 cup of 2% milk and a small bag of chips with 1-2 beers*	<ul style="list-style-type: none"><li>• Tell David that chips are a significant source of both sodium <i>and</i> saturated fat</li><li>• Reduce consumption of chips is a stable recommendation throughout</li><li>• Reduce alcohol consumption, as it may contribute to an increase in triglycerides (this will be discussed later in the section content)</li></ul>
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## Fibre

To increase fibre intake, clients can be encouraged to try to:

- Choose whole vegetables and fruit instead of juice.
- Add extra vegetables and legumes to pasta, curries, casseroles, and soups.
- Leave the skin on vegetables and fruits.
- Add nuts and seeds to salads, yogurt, and cereal.
- Include oatmeal with ground flaxseed as a breakfast food.
- Choose grain products with “whole grain” as the first ingredient.
- Look for 2-4 grams fibre per serving on the Nutrition Facts table.
- Add psyllium husk (like Metamucil) to meals or snacks once per day.

Make sure to add in fibre slowly and increase fluid intake to prevent constipation.



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<https://pressbooks.library.torontomu.ca/dietmods/?p=96#h5p-15>

## David's Fibre Intake

**PES:** Inadequate intake of fibre related to a knowledge deficit of food sources of fibre as evidenced by low intake of vegetables and whole grains.

As we noted during the assessment, David has inadequate fibre. Here are a few suggestions to help David increase his fibre intake.

**Suggestions for David's diet to increase intake of fibre, by meal.**

**[\*] indicates foods in diet recall most relevant to fibre**

Meal	David's diet recall	Suggestions to increase fibre intake
<b>Breakfast</b>	2 eggs, 2 pieces bacon, 1 piece of white bread*, 15 mL butter on bread, 1 coffee with 2 milk (2%)	<ul style="list-style-type: none"> <li>Note: It is often easier to “substitute” or add in other beneficial foods to a client’s diet rather than try to “remove” everything</li> <li>Substitute the white bread for whole grain bread</li> <li>Consider oatmeal as another breakfast option, as it provides a source of soluble fibre</li> </ul>
<b>Lunch</b>	Turkey sandwich (2 slices of white bread*, 2 slices of deli turkey, tbsp of mayo, tbsp of mustard, 2 slices of cheddar cheese, lettuce, and tomato) with 1 cup of soup* (canned tomato or mushroom), 500 mL of water	<ul style="list-style-type: none"> <li>Substitute the white bread for whole grain bread (same as breakfast)</li> <li>Add extra vegetables to the soup</li> </ul>
<b>Dinner</b>	6 ounces of meat (beef), 1 cup mashed potatoes, 1 cup of salad*, 500 mL of water	<ul style="list-style-type: none"> <li>Add legumes or nuts and seeds to the salad</li> </ul>

<b>HS snack</b>	1 bowl of cereal (cheerios*) with 1 cup of 2% milk and a small bag of chips* with 1-2 beers	<ul style="list-style-type: none"> <li>• Substitute cheerios for a bowl of oatmeal</li> <li>• Substitute chips for air-popped popcorn</li> </ul>
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## Physical Activity

Physical activity is an important component of health. It can help control blood pressure. Clients can be encouraged to try the following:

- To achieve health benefits, and improve functional abilities, adults should accumulate at least 150 minutes of moderate- to vigorous intensity aerobic physical activity per week, in bouts of 10 minutes or more.
  - Examples of moderate-to-vigorous intensity activity: brisk walking, dancing, jogging, biking
- It is also beneficial to add muscle and bone strengthening activities using major muscle groups, at least 2 days per week.
  - Major muscle groups: chest, shoulders, back, arms, abs, legs
  - Examples of muscle and bone strengthening activity: jumping rope, weight-lifting, sports (tennis, badminton)
- Those with poor mobility should perform physical activities to enhance balance and prevent falls.

For more information, read the Canadian Society for Exercise Physiology's [24-Hour Movement Guidelines](#).

## David's Physical Activity

- David is not currently interested in engaging in more physical activity, as he would like to focus on dietary changes first.
- Main barrier is the lower back injury.
- Consider speaking to David and his PCP about involving a registered kinesiologist or physiotherapist regarding this barrier.
- No physical activity plan at this time.

## Smoking

Smoking affects blood pressure in 2 ways:

1. Nicotine in cigarette smoke causes blood vessels to narrow, which increases blood pressure.
2. Smoking makes blood pressure medications work less effectively.

Smoking also increases the risk for the buildup of plaque inside the arteries (atherosclerosis).

Counselling on smoking cessation is not within a dietitian's scope, however, if a client is interested in quitting smoking you can provide the following tips:

1. **Set a Quit Date:** Choose a date within the next seven days when you will quit smoking.
2. **Choose a method for quitting:** Stop all at once OR cut down the number of cigarettes per day until you stop completely.
3. **Decide if you need medication or other assistance to quit:** A dietitian can act as a motivator and check in on smoking cessation goals. However, clients should talk to their PCP or be referred to a smoking cessation program to determine if they would benefit from nicotine replacement therapy (NRT).

For more information on quitting smoking, read Heart and Stroke Foundation of Canada's "[Managing your blood pressure](#)" (PDF) resource.

## David's Smoking

- David is not currently interested in quitting smoking. He wants to try and achieve his goals with nutrition-related changes.
- He is open to revisiting this in the future.
- No smoking cessation plan at this time.

## Alcohol Intake

Drinking alcohol can lead to:

- High blood pressure by interfering with the blood flow to and from the heart.
- Possible increase in triglycerides.
- Increase in the release of **VLDL**.
- Increase the flow of free fatty acids to the liver from fat tissue.
- Impede the body's ability to break down fat.

Alcohol can be addictive and high intakes are associated with physical abuse and accidental injury or death. **There is a need for individual consideration.**

As per Canada's updated 2023 Guidance on Alcohol and Health, consuming 7 or more standard drinks per week places individuals at an increasingly high risk of alcohol-related consequences.

Overall, to prevent hypertension and reduce BP in adults, individuals should limit alcohol consumption to  $\leq 2$  drinks per week.

For more information on recommendations surrounding alcoholic beverages, read the Canadian Centre on Substance Use and Addictions ["2023 Canada's Guidelines for Alcohol and Health"](#).

## David's Alcohol Intake

- David reported having 1-2 beers per night (7-14 beers per week).
- David's alcohol consumption places him at an increasingly high risk of alcohol-related consequences, he should consider the effect on his blood pressure and triglycerides (which are above the target range).

- Reducing his alcohol intake may or may not have beneficial outcomes on improving his biochemical data.
- After discussion with David, he does not want to give up alcohol entirely, but wants to try to reduce consumption.
- Plan could be to start by reducing alcohol consumption to 1 beer per night.

## Stress

To help with stress using positive coping strategies clients can try:

- Physical activity
- Socializing
- Laughter
- Engaging in hobbies
- Breathing exercises

Avoid unhealthy stress busters such as:

- Smoking
- Alcohol

If additional help is needed, consider a social worker, therapist, or psychologist.

## David's Stress

- He tells you that he is coping well with his depression since seeing a therapist a couple years ago, and the medication he takes daily has helped.
- He plans to reduce his alcohol intake and is considering smoking cessation in the future.
- He also reports he talks to his wife and socializes with friends to relieve his stress, and doesn't feel it is impacting his health and quality of life at this point.
- No plan for coping with stress is needed at this time.

## Summary of Nutrition Care Plan Recommendations

Now that we have gone through all 9 of the key areas to investigate when creating a nutrition care plan, here is a summary of the recommendations.

**Summary of NCP recommendations, by area**

<b>Area of Concern</b>	<b>Recommendations</b>
<b>Medication Adherence</b>	<ul style="list-style-type: none"> <li>• Check if taking as prescribed</li> <li>• Consider liaising with PCP if changes needed</li> </ul>
<b>Dietary Pattern</b>	<ul style="list-style-type: none"> <li>• Follow the DASH diet or Mediterranean Eating Pattern</li> <li>• Check for any drug nutrient interactions</li> </ul>
<b>Sodium Intake</b>	<ul style="list-style-type: none"> <li>• Aim for &lt; 2000 mg of sodium per day</li> <li>• Limit processed foods with more than 400 mg per serving</li> </ul>
<b>Fat Intake</b>	<ul style="list-style-type: none"> <li>• Choose unsaturated fats most often</li> <li>• Limit saturated fat and avoid trans fat</li> </ul>
<b>Fibre Intake</b>	<ul style="list-style-type: none"> <li>• Increase intake of vegetables, fruit, and legumes</li> <li>• Choose “whole grain” products with 2-4 g per serving</li> </ul>
<b>Physical Activity</b>	<ul style="list-style-type: none"> <li>• 150 minutes moderate to vigorous exercise each week</li> <li>• Resistance exercise 2-3 times per week</li> </ul>
<b>Smoking</b>	<ul style="list-style-type: none"> <li>• Smoking cessation is recommended to reduce the risk</li> </ul>
<b>Alcohol</b>	<ul style="list-style-type: none"> <li>• Moderate consumption (1 drink per day) for women and 2 for men</li> <li>• Consider reduction, if appropriate, as alcohol intake</li> </ul>

<b>Stress</b>	<ul style="list-style-type: none"><li>• Use positive coping strategies (socializing) to deal with stress.</li><li>• Consider referral to <b>SW</b>, therapist, etc.</li></ul>
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When working with clients with hypertension and dyslipidemia, you can refer to this summary and the [Hypertension Canada's Health Behaviour Management Guidelines](#).

## David's NCP Recommendations

David's Nutrition Care Plan could be to:

- Incorporate the principles of the DASH diet
  - Incorporate the recommended daily servings of whole grains, vegetables and fruits, low-fat dairy products, lean meats, nuts, seeds, legumes, fats, and oils.
- Reduce sodium by:
  - Reducing intake of processed deli meats and replacing with baked lean meat.
  - Reduce intake of processed foods like boxed mashed potatoes, chips, and canned soup.
  - Use Nutrition Facts table to look for low sodium options.

- Replace saturated fat intake with unsaturated fats by:
  - Using nut butter instead of butter.
  - Having lean meats, like chicken, or fish instead of beef and bacon.
  - Reducing potato chips as **HS** snack.
- Increase fibre by:
  - Choosing whole grain bread instead of white bread.
  - Adding extra vegetables to soup.
  - Adding legumes or nuts and seeds to salads.
  - Choosing oatmeal instead of cheerios.
  - Start taking Metamucil once per day with lunch.
- Reduce alcohol consumption to 1 beer per day
  - Evaluate the impact as current consumption patterns are within guidelines.

**These recommendations do not have to be implemented all at once.** In the next chapter we'll discuss how to work with David to target his areas of interest and create SMART goals to implement the plan.

PART 2: PLAN COMPLETE. Pause to reflect on the strategies discussed and the potential factors we could

include in David's nutrition care plan. When you're ready, move on to Part 3: Implementation.

# Implement



## Supporting Change

Ongoing management of a chronic disease can lead to burnout, and making dietary changes may be difficult for some patients. To help support them in making these changes, you may want to try:

- **Motivational interviewing:** collect their story, listen reflectively, collaborate rather than convince.
- **SMART goal setting:** help to identify barriers to change as part of creating a nutrition care plan with the client.
- **Referral to social worker:** consider referring them to a social worker if they need someone to talk to about coping with the burden of managing a chronic disease.



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=99#h5p-17>

## David's SMART Goals

As outlined in the Part 2, there are a number of things David can work on as part of his nutrition care plan. Out of those recommendations you work together with him to decide on what to focus on and create these 5 SMART goals to achieve outcomes of reduced cholesterol and BP. As a part of making the goals SMART, you can discuss with him when he plans on making these changes by and come up with ways to support him if or when he encounters barriers.

Use the DASH Diet Recommendations to:

1. Increase vegetable consumption by adding  $\frac{1}{2}$  cup extra vegetables to his soup 1 time per week starting next Monday.
2. Reduce sodium by using the Nutrition Facts table to look for low sodium options when buying foods like canned soup when going grocery shopping this Thursday.
3. Replace saturated fat intake with unsaturated fats by having lean meats, like chicken, or fish 2 times per week instead of beef and bacon starting tomorrow.
4. Increase fibre by choosing whole grain bread instead of white bread and taking Metamucil once per day with lunch starting this Friday.
5. Reduce alcohol consumption to 1 beer per day

starting tomorrow.

## Interdisciplinary Team

When implementing your nutrition care plan, you may have to liaise with other members of the care team. Ongoing management of a chronic disease can lead to burnout, and clients may need someone to talk to, like a social worker, about coping with this extra burden. Injury may be a barrier to initiating physical activity safely and comfortably, so they may benefit from talking to a physiotherapist or kinesiologist. You'll want to discuss if you think a client might benefit from increasing or changing medications, and share successful outcomes. This may include liaising with the physician or nurse practitioner, or cardiologist or specialist. Read about the following roles in more detail if you are not familiar with them.

- **Physician or Nurse Practitioner:** Assess patient needs, order and interpret lab work, diagnose conditions, and prescribe treatment plans.
- **Social Worker:** Provide counselling and identify sources of emotional support for patients and their families to cope with CVD.
- **Physiotherapist or Kinesiologist:** Provide manual therapy and education related to movement and exercise to help people engage in physical activity.
- **Cardiologist or Vascular Specialists:** Specializes in diagnosing and treating diseases of the cardiovascular system. May carry out tests or perform procedures depending on CVD diagnoses.

## Liaising With David's Team

- In this case you have liaised with David's physician regarding your suspicion that the new blood pressure medication may be contributing to constipation. You suggest adding in Metamucil as it may assist with relieving constipation and reducing cholesterol levels. The physician agrees with you.
- You also liaise with the physician regarding David's lower back injury and suggest involvement of a physiotherapist, if and when David decides to start being physically active.

## Education

When implementing your plan with your client you may need to provide some education to them about hypertension, dyslipidemia and nutrition. Like David, many clients may have no prior nutrition education. It is important to start with basic nutrition teaching, despite the need for specific disease-related teaching.

Here are some suggestions for starting a nutrition education plan with a client that has no prior nutrition education:

1. **Ask your client what they know:** Never make an assumption that your client has an understanding of basic nutrition

- information (example, the three types of macronutrients).
2. **Start with the basics:** Even if the client is seeing you for specific disease-related information (i.e. hypertension), it is important to make sure they have a basic understanding.
  3. **Use visuals and plain language** to help convey your messages (e.g. props, resources, handouts). Try to offer resources in the client's first language if you are able.
  4. **Be transparent about time restrictions** and explain your plans for future sessions. You do not have to educate on everything in one counselling session. You can even make a plan with your client breaking down the topics you will cover at each session based on their goals.
  5. **Involve the client in the process** as much as you can. This is a recommendation for the success of all clients; but for an individual who is making nutrition changes for the first time, it is important for motivation, confidence and enjoyment in the process.
  6. **Consider all clients are different.** Some prefer education and understanding, while others want to be told what to do and are not interested in the detailed education. Ask them what they hope to get out of the counselling session so that you can provide them that.

## Using Plain Language with David

An example of a message that you could discuss with David using plain language and visuals is how

atherosclerosis occurs in the body, describing how blood flows through your arteries like water through a hose and can become clogged with plaque, making the artery walls thick and hard. Just like if you put your thumb over the end of a hose, the flow is restricted and pressure builds up.



Photo by [creative2usa](#) on [Pixabay](#)

- Blood flows through your arteries like water through a hose, delivering oxygen and nutrients to your body.
- Atherosclerosis occurs when your arteries become clogged with fatty deposits or plaque.
- Plaque is a sticky mixture of fatty streaks that build up, making the walls of the arteries thick and hard.
- Over time, the artery narrows or gets blocked, and this stops blood from flowing through the artery.

## Education on Label Reading

Another important point to educate David on is label reading, including how to use the nutrition facts table and understand claims when grocery shopping for low sodium options.

Practice identifying the following details on the “Nutrition Facts” label pictured below:

- **Serving Sizes:** compare the serving size on the package to the amount that you eat.
- **% Daily Value:** shows you if a food has a little or a lot of a nutrient. For sodium, choose foods with a lower % DV: 5% or less is considered low in sodium, 15% or more is high.
- **Claims about sodium:** Beware! Sodium-reduced does not necessarily mean low sodium. Low in sodium means less than 140 mg sodium per serving. Salt-free means less than 5 mg sodium per serving.

## Nutrition Facts Valeur nutritive

Per 1 cup (250 ml)  
pour 1 tasse (250 ml)

<b>Calories 110</b>	<b>% Daily Value*</b> <b>% valeur quotidienne*</b>
<b>Fat / Lipides 0 g</b>	<b>0 %</b>
Saturated / saturés 0 g	
+ Trans / trans 0 g	<b>0 %</b>
<b>Carbohydrate / Glucides 26 g</b>	
Fibre / Fibres 0 g	<b>0 %</b>
Sugars / Sucres 22 g	<b>22 %</b>
<b>Protein / Protéines 2 g</b>	
<b>Cholesterol / Cholestérol 0 mg</b>	
<b>Sodium 0 mg</b>	<b>0 %</b>
<b>Potassium 450 mg</b>	<b>10 %</b>
<b>Calcium 30 mg</b>	<b>2 %</b>
<b>Iron / Fer 0 mg</b>	<b>0 %</b>
*5% or less is a little, 15% or more is a lot	
*5% ou moins c'est peu, 15% ou plus c'est beaucoup	

Source: Nutrition Facts Table from Canadian Food Inspection Agency. [Full text description is provided in source.](#)

## David's Education – Key Messages

Overall, to keep it simple focus on these 5 key messages, asking questions throughout. It is also important to consider that David told you his wife does the cooking and grocery shopping. It may be worthwhile to suggest to David that he is welcome to bring his wife to future appointments so that she can receive the education too and learn about making healthy choices.

1. Controlling your blood pressure, cholesterol, and triglycerides is important for reducing your risk for the development of other cardiovascular diseases.
2. You can use the DASH Diet guidelines or CFG Healthy Plate to balance your meals and increase intake of vegetables.
3. You and your wife can use food labels and the Nutrition Facts table to determine the amount of sodium in your food choices when grocery shopping.
4. You can include unsaturated fats (fatty fish and nuts) more often than saturated fats (red meat and butter) to help control your dyslipidemia.
5. You can take Metamucil and include more foods with whole grains by switching to whole grain bread from white bread.

PART 3: IMPLEMENT COMPLETE. Pause to reflect on the implementation strategies discussed. When you're ready, move on to Part 4: Evaluate.

# Evaluate



## Evaluating the Nutrition Care Plan (NCP)

After you have implemented the plan, you want to follow-up and evaluate it to see if it has been effective in addressing your nutrition concerns. This can help you to decide on appropriate changes to make to the nutrition care plan moving forward. To evaluate your plan in a outpatient setting, you will need to set up a follow-up appointment or phone call with your client to gather updated information. Your follow-up appointments and evaluation of the plan should explore previous SMART goals (success, barriers, questions) and aim to set new ones (one per visit to target an area of concern), if the client is ready.

**Questions to evaluate nutrition care plan effectiveness, by issue type**

<b>Common Issues</b>	<b>Questions to Evaluate Effectiveness of NCP</b>
Blood Pressure	<ul style="list-style-type: none"> <li>• Are their BP readings within range?</li> <li>• Are they following the principles of the DASH diet?</li> </ul>
Dyslipidemia	<ul style="list-style-type: none"> <li>• Any improvements in laboratory values (LDL-C, HDL-C, TG)?</li> <li>• Are they including unsaturated and omega-3 fats?</li> <li>• Are they reducing trans and saturated fats?</li> </ul>
Medication	<ul style="list-style-type: none"> <li>• Are they taking medication as directed?</li> <li>• Any improvements in described side effects?</li> <li>• Are they taking the supplements?</li> </ul>
Balanced Meals	<ul style="list-style-type: none"> <li>• Have they made the suggested diet changes?</li> <li>• Any barriers to changes? How is it going (client's perspective)?</li> </ul>
Physical Activity	<ul style="list-style-type: none"> <li>• Any changes in their interest to create a physical activity goal?</li> <li>• Have they seen the PCP about injuries or barriers?</li> </ul>

## Evaluating David's Nutrition Care Plan

At David's follow-up appointment 3 months later, you

evaluate David's nutrition care plan and it seems like he is having great success. Upon evaluation of his biochemical data, you notice a 50% reduction in LDL-C values and within target BP readings. Congratulate David! His triglycerides remain elevated and you ask him about his alcohol intake. He reveals that he did not achieve the goal of reducing his alcohol consumption. This remains a goal to work towards. David tells you that he has very little constipation anymore and enjoys taking the Metamucil. He also tells you that he is using the plate method for at least 80% of his meals and is incorporating more vegetables and fruit in his diet. Continue with the Metamucil and dietary changes, as they are both likely contributing to the positive effects.

Common Issues	Questions to Evaluate Effectiveness of
<b>Blood Pressure</b>	<ul style="list-style-type: none"> <li>• Are their BP readings within range</li> <li>• Are they following the principles of</li> </ul>
<b>Dyslipidemia</b>	<ul style="list-style-type: none"> <li>• Any improvements in laboratory v</li> </ul>
<b>Medication</b>	<ul style="list-style-type: none"> <li>• Any improvements in described si</li> </ul>
<b>Balanced Meals</b>	<ul style="list-style-type: none"> <li>• Have they made the suggested die</li> <li>• How is it going (client's perspectiv</li> </ul>
<b>Physical Activity</b>	<ul style="list-style-type: none"> <li>• Any changes in their interest to cr</li> </ul>

David is doing great. Your role is also to congratulate and motivate adherence to his current success. However, David's triglycerides still remain elevated with no significant change from the initial appointment. He did not meet his goal of reducing alcohol consumption. You want to ask David why he did not adhere to that goal. Is he still interested in reducing consumption? As mentioned, David's alcohol consumption is within moderation. Therefore, reducing consumption may or may not have a benefit to triglyceride levels. However, with no change in his biochemical data it may be worth exploring. You can also ask David if he is willing to revisit engaging in physical activity to improve his triglyceride levels. You may also want to liaise with his PCP regarding the triglyceride levels and inform them of the current success.

David is still experiencing high triglyceride levels (no significant change yet with dietary strategies), which should be addressed in the follow-up by:

- Asking about willingness to reduce alcohol consumption.
- Revisiting willingness to engage in physical activity.
- Setting a goal to reduce alcohol consumption.
- Liaising with his PCP to discuss further options.

## The Nutrition Care Process Model

As you use the Nutrition Care Process Model and the learning from this case study as a guide throughout your patient care in practicum, please keep in mind that the process is dynamic, and

not step-by-step as all cases are different. You are encouraged to complete the recommended readings for this module and continue to expand your learning in this clinical area of practice.

PART 4: EVALUATE COMPLETE. Pause to reflect on the evaluation strategies discussed, and review the readings and resources in the following section for your information.

You've now completed the nutrition for Hypertension and Dyslipidemia module. Please consider providing feedback through the embedded form in the next section.

## Acknowledgements

Daniela Malta, PhD, RD

Michaela Kucab, RD, MHSc

Jess Wiles, RD, MHSc

# Feedback Form



*One or more interactive elements has been excluded  
from this version of the text. You can view them online*

here: [https://pressbooks.library.torontomu.ca/  
dietmods/?p=2240](https://pressbooks.library.torontomu.ca/dietmods/?p=2240)

# Reading List

The following is a list of readings and resources to help supplement your learning in this module topic.

## Readings

- Lane-Cordova AD, Jerome GJ, Paluch AE, Bustamante EE, LaMonte MJ, Pate RR, Weaver RG, Webber-Ritchey KJ, Barone Gibbs B; on behalf of the Committee on Physical Activity of the American Heart Association Council on Lifestyle and Cardiometabolic Health. [Supporting physical activity in patients and populations during life events and transitions: a scientific statement from the American Heart Association.](#) *Circulation.* 2022;145:e117–e128. doi: 10.1161/CIR.0000000000001035
- Lichtenstein AH, Appel LJ, Vadiveloo M, Hu FB, Kris-Etherton PM, Rebholz CM, Sacks FM, Thorndike AN, Van Horn L, Wylie-Rosett J; on behalf of the American Heart Association Council on Lifestyle and Cardiometabolic Health; Council on Arteriosclerosis, Thrombosis and Vascular Biology; Council on Cardiovascular Radiology and Intervention; Council on Clinical Cardiology; and Stroke Council. [2021 Dietary guidance to improve cardiovascular health: a scientific statement from the American Heart Association.](#) *Circulation.* 2021;144:e472–e487. doi: 10.1161/CIR.0000000000001031
- Heart and Stroke Foundation: [Position Statement: Access to affordable, health and nutritious food \(PDF\).](#)
- Canadian Cardiovascular Society eGuidelines: [Dyslipidemia – Health Behaviour Interventions.](#)

# Additional Resources

1. [Canadian Cardiovascular Society Pocket Guides](#)
2. [American Heart Association – Guidelines and Statements](#)
3. UBC Cardiovascular Imaging Research Core Lab : [CardioRisk Calculator](#)

# RENAL

Welcome to the Renal Nutrition section. This will cover the four parts of the Nutrition Care Process (Assess, Plan, Implement, and Evaluate) for patients and clients living with kidney disease. Please follow along with the case study for Raymond in the coloured boxes to practice. There are also interactive activities throughout the section to check your learning.

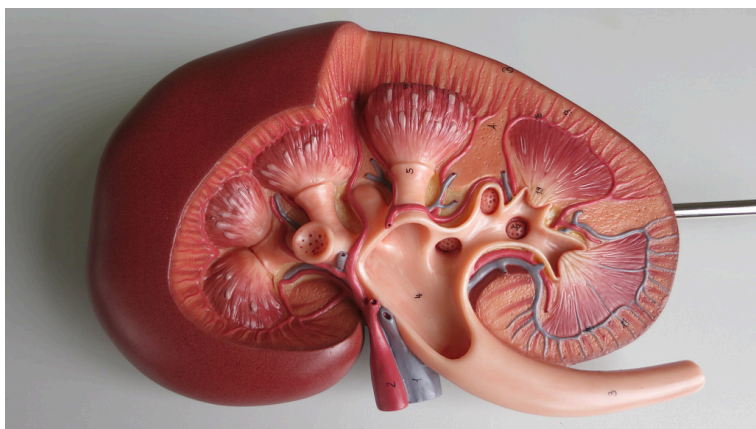


Photo by [John Campbell](#) on [Flickr](#)

## Learning Outcomes

By the end of the section you will be able to:

1. Identify where to gather clinical, anthropometric, biochemical, and dietary data necessary to complete a renal nutrition assessment.
2. Interpret biochemical values, including GFR, creatinine, BUN/urea, potassium, phosphorus, calcium, albumin, A1C,

hemoglobin, and PTH.

3. Analyze the 7 areas of nutrition concern (energy, protein, potassium, phosphorus, sodium, fluid, vitamins) in renal patients and form PES statements for each.
4. Choose an appropriate oral nutrition supplement for patients with kidney disease who require supplementation.
5. Determine a patient's energy and protein needs using data from the initial assessment.
6. Identify strategies to reduce potassium, phosphorus, and sodium in the diet for patients with kidney disease.
7. Choose an appropriate phosphate binder for patients with hyperphosphatemia.
8. Determine the appropriateness of a fluid restriction using fluid intake, urine output, IDWG, BP, SOB, and edema.
9. Understand the roles of 6 members of the nephrology interdisciplinary team, including the nephrologist, nurse practitioner, nephrology nurse, social worker, pharmacist, patient care technician and/or renal technologist.
10. Recognize effective strategies, such as Motivational Interviewing and **SMART goal** setting, to provide education and support behaviour change in those with kidney disease.
11. Evaluate the nutrition care plan using assessment data relevant to the patient nutrition concerns, including malnutrition, abnormal electrolytes, and fluid overload.

# Assess



## Gathering Data for an Assessment

Before asking the patient questions for your assessment, make sure to introduce yourself and set the agenda for the discussion. When gathering data for your assessment make sure to collect information on the patient's:

- Clinical Data
- Anthropometric Data
- Biochemical Data
- Dietary Data and Social History

## Case Study: Meet Raymond



*Raymond  
Zetner,  
your  
patient*

In the case study for this section, you are a Registered Dietitian in cardiology in-patient unit. The patient you are assessing is Raymond Zetner, a 72 year old man with chronic kidney disease (CKD). Raymond was admitted to the cardiology in-patient unit with congestive heart failure. He currently has stage 4 CKD, secondary to hypertension, and is experiencing ankle edema. He does not require dialysis at this time.

He has not yet been discharged from the hospital, and needs education before leaving.

# Clinical Data

When gathering clinical data, consider:

- **Chronic Kidney Disease (CKD):** What stage? What is the cause?
- **Dialysis prescription:** Are they on dialysis? If so, what type and what prescription?
- **Comorbidities:** Ex. Diabetes, hypertension, cardiovascular disease, hyperlipidemia, metabolic syndrome
- **Fluid Status:** How much urine are they producing? Are they retaining fluid? Edema present?
- **GI symptoms:** Constipation, nausea, vomiting, poor appetite, meat aversion, taste changes are common symptoms of **uremia** in advanced CKD.
- **Medications:** Replavite (Vit C & B complex, if on dialysis), Phosphate Binders (Tums/Calcium Carbonate, Sevelamer, Lanthanum), Calcitriol (Active Vitamin D), Iron

## Raymond's Clinical Data

- CKD: Stage 4 CKD, secondary to hypertension
- Dialysis prescription: Does not yet require dialysis
- Comorbidities: Hypertension; patient admitted to hospital with congestive heart failure
- Fluid Status: Ankle edema present

- Medications: Lasix 40 mg **BID**, Ramipril 20 mg OD, Vitamin D 1000 IU OD, Omega-3 250 mg OD

## Anthropometric Data

When gathering anthropometric data, you may retrieve this information from a variety of sources including the patient or their family members, the patient's chart or admission docket, or other healthcare professionals on the interdisciplinary team. Here you will want:

- **Body weight**
- **Weight history:** Usual body weight
- **Dry weight /target weight / goal weight:** Weight without any excess fluid, if on dialysis (edema-free body weight)
- **Inter-dialytic weight gains (if on hemodialysis):** Fluid weight gained between dialysis sessions; this should be no more than 5% of body weight
- **Height**
- **BMI**
- **SGA**

## Raymond's Anthropometric Data

- Weight = 65 kg
- Weight Hx = 62 kg (usual body weight)
- Height = 162 cm
- BMI = 24.7 kg/m<sup>2</sup>
- SGA = A

## Biochemical Data

You also want to gather the following labs included in the table below as part of your biochemical data. Keep in mind that the target ranges for patients with chronic kidney disease and those at end-stage renal disease may be different from the target ranges for the healthy population. Additionally, due lack of consensus and evidence surrounding certain labs values, such as phosphorus and A1C, target ranges may vary based on the physician.

<b>Blood Work</b>	<b>CKD target range</b>	<b>ESRD target range</b>	<b>If high, think:</b>	<b>If low, think:</b>
<b>Creatinine</b>	No target  Will be elevated (>110 mmol/L)	No target  Will be elevated (>110 mmol/L)	Kidney failure	Residual kidney function, overhydration
<b>BUN / Urea</b>	2.5-8.0 mmol/L  Usually elevated (>8 mmol/L)	15-30 mmol/L	Kidney Disease, poor dialysis clearance, high protein intake	Residual kidney function, frequent dialysis, low protein intake
<b>Potassium</b>	3.5-5.0 mmol/L	3.5-5.5 mmol/L	Intake of high potassium foods, K supplementation, K bath, K-sparing medications (ACE inhibitor or ARB)	Low intake, vomiting/diarrhea
<b>Phosphorus</b>	0.8-1.49 mmol/L	1.2-1.8 mmol/L	Intake of high phosphorus foods, inadequate or not taking phosphate binders, high PTH, too much activated vitamin D	Low intake, excessive phosphate binders
<b>Calcium</b>	2.1-2.6 mmol/L	2.1-2.6 mmol/L	Meds (activated vitamin D, Calcium-based phosphate binders)	Poor nutritional status, over hydration
<b>Albumin</b>	35-50 g/L	>40 g/L	Well-nourished / dehydration	Infection / illness / poor nutritional status / overhydration
<b>A1c</b>	<7.0 %	7.1-8.5%	Uncontrolled diabetes	Hypoglycemia

<b>Blood Work</b>	<b>CKD target range</b>	<b>ESRD target range</b>	<b>If high, think:</b>	<b>If low, think:</b>
<b>Hemoglobin</b>	100-120 g/L	100-120 g/L	High Erythropoietin stimulating agent (ESA) dose	High Erythropoietin stimulating agent (ESA) dose, Iron deficiency, GI Bleed/blood loss
<b>PTH</b>	3-12 pmol/L	14-65 pmol/L	Hyperparathyroidism	Adynamic bone disease
<b>Sodium</b>	135-145 mmol/L	135-145 mmol/L	Dehydration, poor intake	Overhydration
<b>Bicarbonate</b>	23-31 mmol/L	23-31 mmol/L	Alkalosis	Metabolic acidosis, high protein intake

## Interpreting Glomerular Filtration Rate

This table contains information that allows you to interpret a patient's Glomerular Filtration Rate (GFR), which estimates the percentage at which their kidney is functioning. Based on their stage of kidney disease, this table also describes what types of actions would be reasonable and the dietary implications.

Stage	Kidney Function (KF)	GFR	Action	Effect on Diet
N/A	At increased risk	>90 with CKD risk factors	Screening, CKD reduction	Usually no effect on potassium (K) or phosphate (PO <sub>4</sub> ). Sodium restriction, Avoid high protein intake >1.3 g/kg/day
I	Kidney damage with normal or ↑ GFR	>90	Diagnosis and treatment of underlying condition, delay progression	Usually no effect on K/PO <sub>4</sub> . Sodium restriction, Avoid high protein intake >1.3 g/kg/day
II	Mild ↓ KF	60-89	Estimating progression, delay progression	Usually no effect on K/PO <sub>4</sub> . Sodium restriction, Avoid high protein intake >1.3 g/kg/day
III	Moderate ↓ KF	30-59	Evaluating and treating complications, delay progression	May have effect on K/PO <sub>4</sub> . Sodium restriction, Avoid high protein intake >1.3 g/kg/day
IV	Severely ↓ KF	15-29	Preparing for kidney replacement therapy, treat complications, delay progression	Likely some effect on K/PO <sub>4</sub> . Sodium restriction, Avoid high protein intake >1.3 g/kg/day
V	Kidney Failure (End Stage Renal Disease - ESRD)	< 15 or dialysis	Renal replacement therapy (dialysis/transplant) if uremia is present	Likely some effect on K/PO <sub>4</sub> . Sodium and fluid restriction. High protein diet required.

## Raymond's Biochemical Data

Here are the labs for Raymond which show that he has severely decreased renal function but does not yet require dialysis. Determine which lab values are WNL or are elevated. This information will be used when developing the nutrition care plan in the next section.

Lab Test	Lab Result **Add units**	Target Range
K	4.7	3.5 - 5.0
PO <sub>4</sub>	1.55	0.8 - 1.45
Ca	2.4	2.1 - 2.6
Creat	662	—
GFR	17	—
Urea	39	2.5 - 8.0
Alb	43	35 - 50
Na	129	135 - 145

## Dietary Data and Social History

When gathering dietary and social history data, consider:

- **Current Diet**
  - Diet order for inpatients
  - How much are they eating and drinking?
  - How is their appetite?
- **Diet Hx**
  - **FFQ**, 24 hour recall, 3-day food record (Note: A food frequency questionnaire might be useful if trying to determine a specific dietary cause of a high serum potassium or phosphorus)
  - Details on protein intake and fluid intake
- **Eating behaviours at home**
  - How many meals per day?
  - Frequency of eating out?
- **Factors affecting intake**
  - Social History: do they have a support system? Housing? Income?
  - Food access and preparation: who does cooking and grocery shopping?

## Raymond's Dietary Data

- Current Diet
  - Regular diet order
  - Fluid intake ~ 2 litres per day
  - Pt reports good appetite in hospital

- Eating behaviours at home
  - Good appetite, eats 3 meals per day
  - Largest meal is dinner
- Factors affecting intake
  - Lives alone
  - Full-time job as a lawyer
  - Eats out often
- Diet recall of typical day prior to admission:
  - Breakfast: 3 eggs, 2 slices bacon, 2 whole wheat toast and 1 double double coffee
  - Lunch: 12 inch assorted meat submarine w/ lettuce, tomato, olives, cheese, mayo and 1 large cola
  - Dinner: Chicken breast (8 ounces), frozen french fries, peas and carrots and 1 can of cola

PART 1: ASSESS COMPLETE. Pause to think about the assessment strategies discussed and data collected. When you're ready, move on to Part 2: Plan.

# Plan



## Creating a Renal Nutrition Care Plan

After you've gathered the information needed for your assessment, you must interpret the data before you can integrate it into your plan. There are 7 key areas to investigate to determine what significant nutrition problems are occurring before creating your plan, including:

- Energy
- Protein
- Potassium
- Phosphorus
- Sodium
- Fluid
- Vitamins

## Common PES Statement Terminology

As you interpret the data from the assessment, you can form Problem, Etiology, Symptoms (PES) statements or nutrition diagnoses that help identify nutrition concerns that need to be addressed in your plan. If you are not familiar with how to write

a PES statement please review this [resource from the Academy of Nutrition and Dietetics](#).

Here are some common nutrition problems that patients with Chronic Kidney Disease (CKD) experience.

- Inadequate energy / protein intake
- Excessive phosphorus / potassium intake
- Excessive fluid / sodium intake
- Increased nutrient needs
- Inadequate vitamin intake (B&C)
- Altered nutrition-related laboratory values
- Involuntary weight loss
- Food and nutrition related knowledge deficit

You can create a PES statement for Raymond as we go through each of the 7 key areas.



*Edema is a common sign of fluid overload, which can occur as renal function declines. Photo by Wang Kai-feng, Pan Hong-ming, Lou Hai-zhou, Shen Li-rong, Zhu Xi-yan, [CC BY 2.0, via Wikimedia Commons](#)*

# Energy

When calculating energy:

- Use weight loss or weight gain to determine if patient is meeting energy requirements on their current diet
- Try to use edema-free weight to calculate energy requirements

If a patient is experiencing unintended weight loss or is consuming inadequate calories, consider:

- Increasing caloric intake via energy-dense foods
- An Oral Nutrition Supplement (ONS)

## Choosing an ONS for Renal Nutrition

When deciding what type of ONS to use for a patient who is not meeting their energy needs, consider if they are on dialysis.

- If the patient is **on dialysis**, choose a formula higher in protein. For example:
  - Nepro (Abbott): high protein, low K, low PO<sub>4</sub>
  - Novasource Renal (Nestle): high protein, low K, low PO<sub>4</sub>
- If the patient is **not on dialysis**, choose a formula lower in protein. For example:
  - Suplena (Abbott): low protein, low K, low PO<sub>4</sub>

If serum K and PO<sub>4</sub> are low secondary to poor intake, you can choose any supplement that meets protein and fluid requirements.



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## Raymond's Energy

**PES** : Adequate caloric intake as evidenced by stable weight and good appetite/intake as per diet history.

- Calories 35 kcal/kg (using 65 kg) = 2275 kcal
- Regular diet order is sufficient to meet energy needs, therefore no ONS are necessary

## Protein

When determining a patient's protein needs, consider if they are on dialysis.

- If the patient is **on dialysis**, aim for 1.2-1.3 g/kg/day
  - May need more depending on additional comorbidities
  - Can use Beneprotein® powder
- If the patient is **not on dialysis**, aim for 0.8 g/kg/day
  - Avoid high protein diet of >1.3 g/kg/day



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## Raymond's Protein

**PES:** Excessive protein intake related to kidney dysfunction and/or nutrition knowledge deficit, as evidenced by high urea (39 mmol/L) and diet history (~15 ounces/105 g animal protein per day).

- Not currently on dialysis
- Avoid high protein diet of >1.3 g/kg/day
- Aim for 0.8 g/kg/day = 52 g/day
- 1 oz animal protein = ~7 grams protein

## Potassium

Is the patient's serum potassium above or below the normal range (3.5 – 5.0 mmol/L)? Use the table below to review actions to take based on the patient's potassium levels.

<b>Patient's potassium levels</b>	<b>Actions to take</b>
<b>Above normal range</b>	<ul style="list-style-type: none"> <li>• Patient may require a low potassium diet and/or education surrounding a low potassium diet</li> </ul>
<b>Within normal range</b>	<ul style="list-style-type: none"> <li>• No potassium restriction required at this time</li> <li>• Continue to monitor serum potassium</li> </ul>
<b>Below normal range</b>	<ul style="list-style-type: none"> <li>• Likely due to poor intake or good kidney function</li> <li>• Can liberalize/omit potassium restrictions and monitor serum potassium levels</li> </ul>

## Reducing Potassium in the Diet

If your patient has high potassium, your plan needs to include how K will be reduced in the diet. To do this the patient can:

- Aim for less than 6 servings per day (less than 200 mg per ½ cup serving) of foods with a high amount of potassium (incl. some specific vegetables, fruit, fruit juice, beans, legumes, and nuts)
- Double boil root vegetables (incl. potatoes, sweet potatoes, and squash)
- Limit consumption of dairy products (incl. milk and yogurt)
- Avoid potassium salt substitutes (incl. “no salt” or “half salt”)

The [Ontario Renal Network Fact Sheet](#) on Potassium lists foods that are high and low in potassium with comprehensive guidelines on limiting specific foods.



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<https://pressbooks.library.torontomu.ca/dietmods/?p=401#h5p-4>

## Raymond's Potassium

**PES:** Adequate potassium intake as evidenced by serum K within normal range (4.7 mmol/L).

No potassium restriction required at this time.

Even though Raymond is on a regular diet and admitted to eating french fries (high K food) at home, his serum K is within normal range and we can continue to monitor.

## Phosphorus

Is the patient's serum phosphorus above or below the normal range (0.8-1.45 mmol/L for pre-dialysis and 0.8-1.8 mmol/L for dialysis)? Use the table below to review actions to take based on the patient's serum phosphorus levels.

<b>Patient's serum phosphorus levels</b>	<b>Actions to take</b>
<b>Above normal range</b>	<ul style="list-style-type: none"> <li>• Patient may require a low phosphorus diet and/or education surrounding a low phosphorus diet</li> <li>• Patient may require phosphate binders or an increase in dose</li> <li>• Make sure patient is taking phosphate binders as prescribed and/or with meals</li> </ul>
<b>Within normal range</b>	<ul style="list-style-type: none"> <li>• No phosphorus restriction required at this time</li> <li>• Continue to monitor serum phosphorus</li> </ul>
<b>Below normal range</b>	<ul style="list-style-type: none"> <li>• Likely due to poor intake or good kidney function</li> <li>• Can liberalize/omit phosphorus restrictions and monitor serum phosphorus levels</li> <li>• Can decrease phosphate binder dose</li> </ul>

## Reducing Phosphorus in the Diet

To reduce the amount of phosphorus in the diet, you can encourage patients to limit their consumption of:

- Processed foods with phosphate additives, like 'phosphoric acid' or 'sodium phosphate' in the ingredients list (incl. commercial baked goods, processed deli meats, processed cheese, cola, frozen meats)
- Dairy products to ½ -1 cup per day
- Large quantities of nuts and chocolate

Although meat, poultry and fish contain phosphorus, they are not restricted as they are an important source of protein in the diet.

To allow for the recommended intake of meat, poultry and fish, phosphate binders can be added to control phosphorus amounts in the body.

Although whole grains and legumes used to be restricted as part of a low phosphorus diet, studies have shown that they are not entirely absorbed in the gut. As a result they are now generally allowed as part of the renal diet.

The [Ontario Renal Network Fact Sheet](#) on Phosphorus lists foods that are high and low in phosphorus with comprehensive guidelines on limiting specific foods.

## Consider Phosphorus Binders

You can use this table to help you determine which phosphate binder is the best choice for your patients based on the advantages and disadvantages of each type.

In order to phosphate binders to work effectively, they must be taken WITH food (ideally in the middle of a meal or snack). They should not be taken at the same time as iron supplements.

Phosphate Binder	Advantages	Disadvantages	Dosing Info
<b>Calcium Carbonate (Tums)</b>	<ul style="list-style-type: none"> <li>• Excellent binder</li> <li>• Inexpensive</li> <li>• 1st line of therapy unless patient is hypercalcemic</li> </ul>	<ul style="list-style-type: none"> <li>• Risk for calcification</li> <li>• Contraindicated if pt is hypercalcemic</li> </ul>	<ul style="list-style-type: none"> <li>• Generic Brand Ca Carbonate 1250 mg = 500 mg Ca</li> <li>• Tums Ultra strength 1000 mg = 400 mg elemental Ca</li> <li>• Tums Extra strength 750 mg = 300 mg elemental Ca</li> </ul>
<b>Sevelamer (Renagel)</b>	<ul style="list-style-type: none"> <li>• Non-calcium based</li> <li>• Less risk of hypercalcemia</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive (often used if pt has coverage)</li> <li>• GI side effects</li> <li>• Risk of acidosis</li> <li>• Increases pill burden</li> </ul>	<ul style="list-style-type: none"> <li>• Comes in 800 mg tabs</li> </ul>
<b>Lanthanum (Fosrenal)</b>	<ul style="list-style-type: none"> <li>• Non-calcium based</li> <li>• Less risk of hypercalcemia</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive (often used if pt has coverage)</li> <li>• GI side effects</li> </ul>	<ul style="list-style-type: none"> <li>• Comes in 250 mg, 500 mg and 1000 mg tabs (single tab for dosage = less pill burden)</li> </ul>

<b>Sucroferri Oxyhydroxide (Velphoro)</b>	<ul style="list-style-type: none"> <li>• Non-calcium based</li> <li>• Less risk of hypercalcemia</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive (often used if pt has coverage)</li> <li>• GI side effects</li> <li>• Reduced pill burden</li> </ul>	<ul style="list-style-type: none"> <li>• 500 mg tabs, usually 3-4 tablets required daily</li> </ul>
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## Raymond's Phosphorus

**PES:** Excessive PO<sub>4</sub> intake related to reliance on processed foods and kidney dysfunction, as evidenced by diet history (high P foods such as, deli meats & bacon) and hyperphosphatemia

(serum PO<sub>4</sub> 1.55).

- Consider low phosphorus (800-1000 mg) diet and/or PO<sub>4</sub> binders
- Calcium-based PO<sub>4</sub> binders are reasonable to start, since serum Ca is within normal range
- Liaise with team to start with 1 tab daily with dinner (largest meal)

## Sodium

Sodium restriction (<2000 mg per day) is beneficial across all stages of CKD as it can help to:

- Lower blood pressure
- Maintain fluid balance
- Control thirst

To reduce sodium in the diet at home, patients can:

- Choose homemade foods more often
- Limit consumption of processed foods, which contribute > 75% of sodium in the diet

The [Ontario Renal Network Fact Sheet](#) on Sodium has comprehensive guidelines on reducing sodium in patients with chronic kidney disease.



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## Raymond's Sodium

**PES:** Excessive sodium intake related to knowledge deficit / reliance on convenience foods, as evidenced by diet history, edema, and CHF.

Aim for sodium intake less than 2000 mg/day

## Fluid

A fluid restriction is usually only necessary for patients on

hemodialysis and can be determined by checking the interdialytic weight gains (IDWG). Some patients in the late stages of pre-dialysis may require a fluid restriction depending on:

- The amount of urine output vs. fluid intake
- The amount of IDWG
- Blood Pressure (BP)
- Shortness of Breath (SOB)
- Edema (swelling in extremities)
- History of congestive heart failure

Fluid restriction always goes in conjunction with a sodium restriction. Otherwise, the patient will be very thirsty.

You can also liaise with the in-patient team members (i.e. doctors, nurse practitioners) to help determine fluid requirements.



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<https://pressbooks.library.torontomu.ca/dietmods/?p=401#h5p-7>

## Raymond's Fluid

**PES:** Excessive fluid intake related to cardiac and kidney dysfunction, as evidenced by diet history (2L fluid intake/day), edema, hyponatremia (Na 129) and admission for congestive heart failure.

- Fluid restriction always goes in conjunction with a sodium restriction
- Fluid intake should be restricted to 1.5 L per day, after liaising with team to determine optimal fluid restriction given his history of CHF and CKD

## Vitamins

When eGFR decreases to less than 30 mL per min, vitamin supplementation can be considered if dietary intake suggests a need. The supplement should not include vitamin A or Magnesium.

While on dialysis, water soluble vitamins (B and C) are lost so it is important to:

- Replace vitamins lost by taking Replavite® after dialysis once daily
- Avoid regular multi-vitamins in dialysis patients, as toxicity of vitamin A is possible

Replavite® is a multivitamin developed specifically for patients with kidney disease and is similar to a B complex + vitamin C. The ingredients include:

- Vitamin B1 (Thiamine Mononitrate) 1.5 mg
- Vitamin B12 (Cyanocobalamin) 6 mcg
- Vitamin B2 (Riboflavin) 1.7 mg
- Vitamin B6 (Pyridoxine Hydrochloride) 10 mg
- Vitamin C (Ascorbic Acid) 100 mg
- Biotin 300 mcg
- D-Pantothenic Acid (Calcium D-Pantothenate) 10 mg
- Folic Acid 1 mg
- Nicotinamide 20 mg



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<https://pressbooks.library.torontomu.ca/dietmods/?p=401#h5p-8>

## Raymond's Vitamins

- Raymond is not on dialysis and has adequate intake. He does not require Replavite® at this time
- He benefits from taking vitamin D and omega-3, which can continue to be administered

## Summary of Nutrition Care Plan Recommendations

Now that we have gone through all 7 of the key areas to investigate when creating a nutrition care plan, here is a summary of the recommendations. You can refer to this summary when working with patients with CKD in your practicum if needed.

Nutrient	CKD/ Pre-Dialysis	Hemodialysis	Peritoneal Dialysis
<b>Energy (kcal/kg/ day)</b>	25 - 35	25 - 35	25 -35
<b>Protein (g/kg/day)</b>	0.6 - 0.8	1.0 - 1.2	1.0 -1.2
<b>Potassium (mg/day)</b>	Individualized (Restrict if high K+)	2000 - 4000 (50 - 100 mmol/ day)	Individualized (Restrict if high K+)
<b>Phosphorus (mg/day)</b>	800 - 1000, only if PO <sub>4</sub> >1.5 mmol/L	800 - 1000	800 - 1000
<b>Sodium (mg/day)</b>	< 2300	< 2300	< 2300
<b>Fluid (mL /day)</b>	Usually not restricted	1000 mL + urine output	Individualized (Restrict if needed)
<b>Vitamins</b>	Usually not required	Replavite® OD after dialysis	Replavite® OD

## Summary of PES Statements for Raymond

Here is a list of all of the nutrition problems that we identified for Raymond using the information we gathered in our assessment and will address in the nutrition care plan.

1. Adequate caloric intake as evidenced by stable weight and good appetite.

2. Excessive protein intake related to kidney dysfunction, as evidenced by high urea and diet history.
3. Adequate potassium intake as evidenced by serum K within normal range.
4. Excessive PO<sub>4</sub> intake related to reliance on processed foods and kidney dysfunction, as evidenced by diet history, hyperphosphatemia.
5. Excessive sodium intake related to knowledge deficit / reliance on convenience foods, as evidenced by diet history, edema, CHF.
6. Excessive fluid intake related to cardiac and kidney dysfunction, as evidenced by diet history, edema, hyponatremia, and CHF.

## Raymond's Nutrition Care Plan

Our nutrition care plan for Raymond includes:

1. Diet Order:
  - Regular protein (0.8 g/kg/d)
  - Low phosphorus (800-1000mg)
  - Low sodium (85 mmol)
  - 1.5 L fluid restriction

2. Consider starting 1 tab calcium-based phosphate binder daily with dinner (his largest meal).

## Creating a Nutrition Care Plan for Diabetes

**Note:** This section of the Plan stage does not concern our client Raymond, as he does not have diabetes. However, it is important for you to know when working with this population in your practicum.

Diabetes is the leading cause of CKD, therefore, it is common to create nutrition care plans for patients on renal and diabetic diets. To reduce confusion caused by conflicting diet recommendations, tell your patient to try to:

- Eat at regular times throughout the day, no more than six hours apart
- Eat the same amount of carbohydrate-containing foods at each meal
- Limit simple sugars and sweets such as regular pop/soda/soft drinks, fruit juices, sweet desserts, candies, jam, honey, and sugar
- Control blood sugar to help control thirst and fluid gains
- Avoid salt substitutes and processed foods high in sodium
- Choose lean protein foods prepared with little added fat

- Choose low phosphorus and low potassium foods, if necessary (limit whole wheat foods last)
- Do some physical activity each day

The [Ontario Renal Network Fact Sheet](#) on diabetes and diet has comprehensive guidelines on diet recommendations for those with diabetes and CKD.

PART 2: PLAN COMPLETE. Please pause to reflect on the nutrition care plan we created for Raymond. When you're ready, move on to Part 3: Implementation.

# Implement



## Interdisciplinary Team

When implementing your nutrition care plan, you may have to liaise with other members of the care team. This is particularly pertinent if a patient requires a fluid restriction or if they are starting or taking a phosphate binder.

- **Nephrologist:** Doctors who have advanced training in treating kidney disease
- **Nurse Practitioner:** A registered nurse with advanced education to be able to assess, diagnose, treat and monitor a wide range of health problems
- **Nephrology Nurse:** A nurse with specialized experience in the care of patients with chronic kidney disease.
- **Social Worker:** Provide counselling and identify sources of emotional support for patients and their families cope with kidney disease
- **Pharmacist:** Review the patient's medication orders for appropriateness and ensure that the right medication and the right dose is administered
- **Patient Care Technician and/or Renal Technologist:** Responsible for the education, maintenance and cleaning of renal equipment, such as dialysis machines.



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## Liaising with Raymond's Team

In Raymond's case, you can liaise with:

- The nurse practitioner and/or nephrologist about Raymond's fluid restriction
- The nephrologist, nurse practitioner, and/or nurse regarding the changes to Raymond's diet order
- Liaise with the nephrologist and pharmacist to start 1 tab calcium-based phosphate binder daily with dinner (his largest meal), since it is not within the RD scope of practice to prescribe phosphate binders

## Education

When implementing your plan, you will spend some time speaking

with the patient about kidney disease and the dietary changes they may have to make. When providing education to patients try to:

- **Individualize the education as much as possible**, based on their stage of kidney disease and labs. If the patient's potassium and phosphorus is not elevated, then no K/PO<sub>4</sub> intervention is required at that time, and you can continue to monitor
- **Find out if patient has had previous education:** Ask the patient if any one else has talked to them about their diet and kidney disease. If the patient is followed by another renal dietitian, it might be worthwhile to reach out to them to gain additional information about the patient's situation and provide a summary of your nutrition interventions while in hospital.
- **Focus on a few key messages:** If the patient is newly diagnosed or doesn't know much about kidney disease, try not to overwhelm them with too much information during your first couple of interactions

Think of some key messages you might want to speak to Raymond about when providing education as you implement the nutrition care plan.

## Raymond's Education – Key Messages

Before implementing the diet order, you need to meet with Raymond to go over the plan with him. In your

meeting with him, you can explain the reasons for the dietary changes and what that means in terms of the types of foods he will be receiving while he is in the hospital. When you ask him if he has been told to make diet changes before, he tells you the only thing he remembers that his family doctor has told him many times to cut back on the amount of salt he is eating because of his history of high blood pressure.

You decide to talk to him about 3 key messages related to the changes to his diet:

1. Your kidneys are not able to filter enough fluid and salt from your blood. So when you drink a lot of fluid and eat too much salt, the fluid builds up in your ankles, making them swollen. To try to reduce the swelling, you will get foods that are lower in salt and only get about 6 cups of fluid to drink in a day.
2. Some foods, like processed meat, cheese, and milk contain higher amounts of phosphorus. You won't get these foods very often on your tray at the hospital because your kidneys cannot process a large amount of phosphorus.
3. Your kidneys are also not able to process high amounts of protein, which is why you may receive smaller portions of meat in your meals than you are used to having.

Practice explaining the three key messages in plain language.

## Using analogies

It can also be helpful to use simple analogies. For example, kidneys are like oil filters in cars. In using this analogy to help educate a client about kidney disease, you could say:

“In our bodies, the kidneys’ role is to clean and filter our blood, kind of like how cars need filters to clean the oil that moves throughout the engine to keep it running. Sometimes when filters get old or they break they are not able to filter the oil properly. This is what happens when you have kidney disease since your kidneys can no longer clean the blood the way they used to, so we need to make some changes to ensure your body can still function.”



Image by [nastogadka](#)  
via [Pixabay](#)

# Supporting Change

Ongoing management of a chronic disease can lead to burnout, and making dietary changes may be difficult for some patients. To help support them in making these changes, you may want to try:

- **Motivational interviewing:** collect their story, listen reflectively, collaborate rather than convince
- **SMART goal setting:** help to identify barriers to change as part of creating a nutrition care plan with the client
- **Referral to social worker:** consider referring them to a social worker if they need someone to talk to about coping with the burden of managing a chronic disease

In Raymond's case, he could set some SMART goals as part of his discharge plan on how he can reduce his sodium, protein, phosphorus and fluid intake once he returns home.

Think about some SMART goals that you could set in collaboration with Raymond.

## Raymond's SMART Goals

Using recommendations from the [Ontario Renal Network Fact Sheets](#), once Raymond returns home, he can reduce his sodium, protein, phosphorus, and fluid intake by trying to:

- Limit consumption of processed foods with phosphate additives and salt (like bacon, frozen french fries, and pop)
- Choose more fresh, homemade, and unprocessed foods (like fresh or frozen vegetables and unprocessed meat, poultry, and fish)
- Reduce the amount of meat, poultry, and fish consumed at each meal (like having 3 ounces of chicken breast instead of 8 ounces)
- Drink a maximum of 6 cups of fluid per day, including coffee/tea, pop, water, milk, and anything that melts at room temperature

As a part of making the goals SMART, you can discuss with him when he plans on making these changes and come up with ways to support him if or when he encounters barriers.

## Suggestions for Raymond's Diet

This table shows what a typical day for Raymond could look like when making choices that help to reduce his sodium, protein, phosphorus, and fluid intake once he is discharged. The changes made are **bolded** in the “After” column.

Meal	Before (Raymond's diet recall)	After (Diet suggestions)
<b>Breakfast</b>	3 eggs, 2 slices bacon, 2 whole wheat toast and 1 double double coffee	Sandwich with <b>2 eggs, tomato</b> , 2 whole wheat toast, and 1 coffee with milk and sugar
<b>Lunch</b>	12 inch assorted meat submarine w/ lettuce, tomato, olives, cheese, mayo and 1 large cola	12 inch <b>tuna</b> submarine w/ lettuce, tomato, cheese, mayo, and <b>1 medium sprite or ginger ale</b>
<b>Dinner</b>	Chicken breast (8 ounces), frozen french fries, peas and carrots and 1 can of cola	Chicken breast ( <b>3 ounces</b> ), <b>mashed or roast potatoes</b> with herbs, peas and carrots, and <b>1 cup of water</b>

## Simulation Activity: Raymond



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=403#h5p-61>

PART 3: IMPLEMENT COMPLETE. Pause to reflect on the implementation strategies discussed. When you're ready, move on to Part 4: Evaluation.

# Evaluate



## Evaluating the Nutrition Care Plan

After you have implemented the plan, you want to follow-up and evaluate it to see if it has been effective in addressing your nutrition concerns. This can help you to decide on appropriate changes to make to the nutrition care plan moving forward. When evaluating your plan in an inpatient setting, you will need to gather updated information from the same key areas of nutrition concern that you identified in your initial assessment.

In populations with chronic kidney disease, the three main areas to commonly re-assess include:

1. Malnutrition
2. Abnormal electrolytes
3. Fluid overload

<b>Common Nutrition Issues</b>	<b>Evaluate effectiveness of NCP</b>
<b>Malnutrition</b>	<ul style="list-style-type: none"> <li>• Has weight increased?</li> <li>• Improvements in appetite?</li> <li>• Increased protein or caloric intake from diet history?</li> <li>• Improvements in pre-dialysis urea? (for dialysis pts)</li> </ul>
<b>Abnormal Electrolytes</b>	<ul style="list-style-type: none"> <li>• If hyper/hypo-kalemic, can ask for a repeat of serum potassium</li> <li>• If hyper/hypo-phosphatemic, can ask for a repeat of serum phosphorus</li> <li>• If taking phosphate binders, can ask for repeat calcium and phosphorus</li> <li>• Appropriate changes in diet and/or nutrition knowledge?</li> </ul>
<b>Fluid Overload</b>	<ul style="list-style-type: none"> <li>• Improvements in fluid/sodium intake from diet history?</li> <li>• Improvements in edema, weights, <b>SOB</b>, <b>IDWG</b> (if on dialysis)?</li> </ul>

## Evaluating Raymond's Nutrition Care Plan

When assessing Raymond's status after the implementation of your nutrition care plan, you want to see if his phosphorus levels are WNL since he was previously hyperphosphatemic, so you request a repeat for serum

phosphorus. You also decided to start a calcium based phosphate binder after liaising with the team, so you'll want to request a calcium level as well. Finally you'll want to check his fluid status by seeing if there have been any improvements in his edema.

The results of the lab work you requested show that his serum phosphorus is 1.42 and is now WNL, but his calcium went up slightly to 2.55 as a result of starting the calcium-based phosphate binders. This means you'll have to keep an eye on his calcium and switch to a non-calcium based binder if it continues to rise. There has also been slight improvements in his ankle edema. As part of the plan you will continue the fluid restriction and low sodium diet and continue to monitor his fluid status and edema.

Keep in mind that another part of evaluation that occurs in outpatient settings is following up with the patient regarding the SMART goals they set.

<b>Common Nutrition Issues</b>	<b>Evaluate effectiveness of NCP</b>	<b>Outcome</b>
<b>Malnutrition</b>	No concerns at this time	-
<b>Abnormal Electrolytes</b>	<ul style="list-style-type: none"> <li>• Previously hyperphosphatemic, so ask for a repeat of serum phosphorus</li> <li>• Taking calcium-based phosphate binder, so ask for repeat calcium</li> </ul>	<ul style="list-style-type: none"> <li>• Serum PO4 = 1.42 mmol/L (WNL)</li> <li>• Ca = 2.55 mmol/L (up slightly from 2.4 mmol/L on admission)</li> </ul>
<b>Fluid Overload</b>	<ul style="list-style-type: none"> <li>• Improvements in fluid/sodium intake from diet history?</li> <li>• Improvements in edema?</li> </ul>	<ul style="list-style-type: none"> <li>• Slight improvements</li> </ul>

## The Nutrition Care Process Model

As you use the Nutrition Care Process Model and the learning from this case study as a guide throughout your patient care in practicum, please keep in mind that the process is dynamic, and not step-by-step as all cases are different. You are encouraged to complete the recommended readings for this module and continue to expand your learning in this clinical area of practice.

PART 4: EVALUATE COMPLETE. Pause to reflect on the evaluation strategies discussed, and review the readings and resources in the following section for your information.

You've now completed the Renal nutrition module. Please consider providing feedback through the embedded form in the next section.

## Acknowledgements

Arti Sharma Parpia, RD, MSc

Jess Wiles, RD, MHSc(c)

# Feedback Form



*One or more interactive elements has been excluded  
from this version of the text. You can view them online*

here: [https://pressbooks.library.torontomu.ca/  
dietmods/?p=2242](https://pressbooks.library.torontomu.ca/dietmods/?p=2242)

# Reading List

The following is a list of readings and resources to help supplement your learning in this module topic.

## Readings

- Canadian Journal of Diabetes Clinical Practice Guidelines: [Chapter 29. Chronic Kidney Disease in Diabetes](#).
- The Ottawa Hospital and Renfrew Victoria Hospital: [Comparing treatment options for when your kidneys are not working \(PDF\)](#).
- Ikizler TA, Burrowes JD, Byham-Gray LD, et al; KDOQI Nutrition in CKD Guideline Work Group. [KDOQI clinical practice guideline for nutrition in CKD: 2020 update](#). *Am J Kidney Dis*. 2020;76(3)(suppl 1):S1-S107.
- National Kidney Foundation, 2000: [KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure](#).

## Other Resources

- [The Kidney Foundation of Canada](#).
- The Kidney Foundation of Canada: [Kidney Community Kitchen](#)
- Ontario Renal Network: [Clinical Tools & Education](#)



# OUTPATIENT GI

Welcome to the Outpatient GI Nutrition section. This will cover the four parts of the Nutrition Care Process (Assess, Plan, Implement, and Evaluate) for patients and clients living with various gastrointestinal illnesses followed in outpatient settings. Please follow along with the case study for Christian in the coloured boxes to practice. There are also interactive activities throughout the section to check your learning.



Photo by [SHVETS production](#) from [Pexels](#)

## Learning Outcomes

By the end of the section you will be able to:

1. Identify where to gather clinical, anthropometric,

psychosocial, biochemical, and dietary data necessary to complete a nutrition assessment for a client living with GI diseases or conditions.

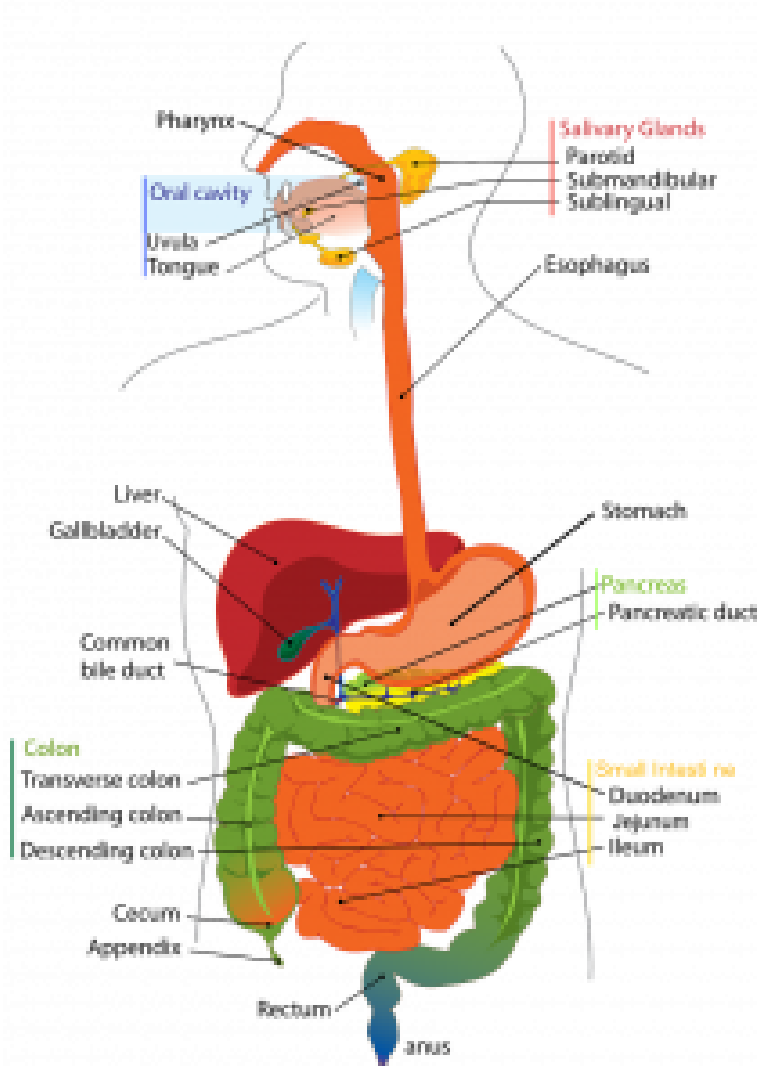
2. Understand the pathophysiology and diagnosis of four GI diseases: Irritable Bowel Syndrome (IBS), Gastroesophageal Reflux Disease (GERD), Celiac Disease, and Diverticulitis.
3. Identify education and recommendations for individuals living with Irritable Bowel Syndrome (IBS), Gastroesophageal Reflux Disease (GERD), Celiac Disease, and Diverticulitis.
4. Identify strategies to improve symptoms in individuals living with IBS and GERD.
5. Understand the roles of the members of the interdisciplinary team.
6. Evaluate the nutrition care plan using assessment data relevant to the client nutrition concerns, including symptom management, diet changes, medications, supplements, lifestyle factors, and physical activity.
7. Recognize effective strategies, such as motivational interviewing (MI) and **SMART goal** setting, to provide education and support behaviour change.

# Background

## The Gastrointestinal (GI) Tract

There are three main functions of the gastrointestinal tract, including transportation, digestion, and absorption of food. This takes place in three different phases of digestion: cephalic, gastric, and intestinal.

The gastrointestinal system begins with the mouth, leading to the esophagus and extends through the stomach, small and large intestine to the anus. Food is digested in the stomach and nutrients are absorbed in the small intestine. In the large intestine, water is reabsorbed and fecal matter is expelled through the rectum. The pancreas, liver, and gallbladder also have a role in digestion.



The upper and lower GI tract  
 Source: Sarahguess5, [CCO](#), via [Wikimedia Commons](#)

## GI Tract Components

The table below provides a brief overview of the different GI tract components, outlining a process that starts in the oral cavity extending to the large intestine in preparation for elimination.

**Overview of GI tract components**

<b>Component</b>	<b>Brief Explanation</b>
Oral Cavity, Teeth and Tongue	Mechanical processing, moistening, and mixing with salivary secretions. Carbohydrate digestion begins in the mouth via enzymatic action (i.e. salivary amylase).
Salivary Glands	Secretion of lubricating fluid containing enzymes that breakdown carbohydrates.
Pharynx	Pharyngeal muscles propel materials into the esophagus.
Esophagus	Transport of materials to the stomach.
Stomach	Chemical breakdown of materials via acid and enzymes; mechanical processing through muscular contractions. Protein digestion occurs in the stomach (i.e. pepsin).
Liver	Secretion of bile (important for lipid digestion), storage of nutrients, and many other vital functions.
Gallbladder	Storage and concentration of bile.
Pancreas	Exocrine cells secrete buffers and digestive enzymes; endocrine cells secrete hormones.
Small Intestine	Enzymatic digestion and absorption of water, organic substrates, vitamins, and ions. Carbohydrate (i.e. lipase) and fat (i.e. pancreatic lipase and bile) digestion occurs mostly in the small intestine. Protein digestion occurs further in the small intestine (i.e. trypsin).
Large Intestine	Dehydration and compaction of indigestible materials in preparation for elimination.

## Digestive Hormones or Enzymes

The table below provides a brief overview of key digestive hormones

or enzymes in the GI tract. These have been selected as a refresher of the physiological mechanisms and localizations.

### Overview of digestive hormones or enzymes

Hormone or Enzyme	Localization	Main Physiologic Actions
<b>Amylase</b>	Mouth (salivary amylase) and pancreas	Initiates the digestion of carbohydrates in the form of starches by catalyzing the hydrolysis of polysaccharides into disaccharides.
<b>Lipase</b>	Mouth, stomach and pancreas	A lipase is any enzyme that catalyzes the hydrolysis of fats. Lipases perform essential roles in digestion, transport and processing of dietary lipids.
<b>Pepsin</b>	Stomach	Pepsin is an endopeptidase that breaks down proteins into smaller amino acids. It helps digest the proteins in food.
<b>Gastrin</b>	Stomach, duodenum, pancreas	Gastrin is a peptide hormone that stimulates secretion of gastric acid ( <b>HCl</b> ) by the parietal cells of the stomach and aids in gastric motility.
<b>Secretin</b>	Small intestine (duodenum)	Secretin is a hormone that regulates water homeostasis throughout the body and influences the environment of the duodenum by regulating secretions in the stomach, pancreas, and liver. It helps regulate the pH of the duodenum by (1) inhibiting the secretion of gastric acid from the parietal cells of the stomach and (2) stimulating the production of bicarbonate from the ductal cells of the pancreas.
<b>Cholecystokinin (CCK)</b>	Small intestine (duodenum)	A peptide hormone of the gastrointestinal system responsible for stimulating the digestion of fat and protein. It is released after a meal, aiding digestion and reduces appetite.

<b>Motilin</b>	Small intestine (duodenum and jejunum)	The main function of motilin is to increase the migrating myoelectric complex component of gastrointestinal motility and stimulate the production of pepsin. Motilin participates in controlling the pattern of smooth muscle contractions in the upper gastrointestinal tract.
<b>Gastric inhibitory peptide (GIP)</b>	Small intestine (duodenum)	Secreted from the intestine on ingestion of glucose or nutrients to stimulate insulin secretion from pancreatic $\beta$ cells.
<b>Glucagon-like peptide-1 (GLP-1)</b>	Small intestine (distal ileum and colon)	GLP-1 lowers hepatic glucose output, which helps to lower blood sugars. It also stimulates the release of insulin by the pancreas. It also promotes satiety by affecting gut motility.
<b>Ghrelin</b>	Mainly stomach, small amounts by small intestine and pancreas	It stimulates appetite, increases food intake and promotes fat storage. Also known as the “hunger hormone”.
<b>Leptin</b>	Produced in adipocytes of white adipose tissue	Leptin is a hormone generated by fat cells. Its main role is to regulate fat storage and energy homeostasis.
<b>Peptide YY (PYY)</b>	Small intestine (ileum) and the colon	PYY main function is to reduce appetite and limit food intake. It decreases food intake by inhibiting gut motility.

## Gastrointestinal Nutrient Absorption

It is important when seeing clients with various GI related diseases or concerns, to understand where nutrients are absorbed. This is particularly important when individuals have a compromised GI tract, such as absorption issues in relation to disease or surgery affecting a section of the GI tract. You can refer to the table below in practice.

**Gastrointestinal nutrient absorption, by part of GI tract**

Source: [Epomedicine: Site of absorption of Vitamins, Minerals and Nutrients](#)

<b>Part of the GI tract</b>	<b>Nutrients absorbed</b>
Stomach	<ul style="list-style-type: none"><li>• Water</li><li>• Ethyl alcohol</li><li>• Copper</li><li>• Iodide</li><li>• Fluoride</li><li>• Molybdenum</li></ul>
Duodenum	<ul style="list-style-type: none"><li>• Calcium</li><li>• Phosphorus</li><li>• Magnesium</li><li>• Iron</li><li>• Copper</li><li>• Selenium</li><li>• Niacin</li><li>• Riboflavin</li><li>• Thiamin</li><li>• Biotin</li><li>• Folate</li><li>• Vitamin A, D, E, K</li></ul>

Jejunum	<ul style="list-style-type: none"> <li>• Lipids</li> <li>• Monosaccharides</li> <li>• Amino Acids</li> <li>• Small Peptides</li>   <li>• Thiamin</li> <li>• Riboflavin</li> <li>• Niacin</li> <li>• Pantothenate</li> <li>• Biotin</li> <li>• Folate</li> <li>• Vitamin B6</li> <li>• Vitamin C</li> <li>• Vitamin A, D, E, K</li> <li>• Calcium</li> <li>• Phosphorus</li> <li>• Magnesium</li> <li>• Iron</li> <li>• Zinc</li> <li>• Chromium</li> <li>• Manganese</li> <li>• Molybdenum</li> </ul>
Ileum	<ul style="list-style-type: none"> <li>• Vitamin C</li> <li>• Folate</li> <li>• Vitamin B12</li> <li>• Vitamin D</li> <li>• Vitamin K</li> <li>• Magnesium</li> <li>• Others, depending on transit time</li> <li>• Bile salts and acids</li> </ul>
Large Intestine	<ul style="list-style-type: none"> <li>• Water</li> <li>• Short-chain fatty acids</li> <li>• Vitamin K</li> <li>• Biotin</li> <li>• Sodium</li> <li>• Chloride</li> <li>• Potassium</li> </ul>

## Intestinal Transit Times

There have been many studies on GI transit, and the table below presents rough estimates for transit times in healthy people following ingestion of a standard meal (i.e. solid, mixed foods). These are estimates of average transit times and there is a great deal of variability among individuals and within the same person at different times and after different meals.

**Estimates for intestinal transit times. Adapted from the Sunnybrook Clinical Nutrition Resource Handbook.**

Transit Stage	Transit Time (hrs)
50% of stomach contents emptied	2.5 – 3.0
Total emptying of the stomach	4.0 – 5.0
50% emptying of the small intestine	2.5 – 3.0
Transit through the colon	30 – 40

There are gastrointestinal motility tests used to check transit times and for certain diseases; examples of motility tests include: gastrointestinal transit scintigraphy, radiopaque marker tests, hydrogen breath test, and esophageal manometry. You should explore what these tests (and others you may encounter) are traditionally used for and how they work.

## GI Diseases

The following GI diseases will be covered in this section:

- Irritable Bowel Syndrome (IBS)
- Gastroesophageal Reflux Disease (GERD)
- Celiac Disease

- Diverticulitis

When you are evaluating the case study, you will notice it is focused on IBS and GERD, as this combination is common in practice. However, you will be provided with an overview and recommendations related to celiac disease and diverticulitis to use in practice.

## Irritable Bowel Syndrome

Irritable bowel syndrome (IBS) is a common gastrointestinal (GI) disorder of gut-brain interaction characterized by recurrent abdominal pain associated with altered bowel habits.

The pathophysiology of IBS is not completely understood. There is a genetic predisposition and external triggers. Foods do not cause IBS, rather they do not allow tissues to heal by virtue of passing through. Pathological abnormalities include visceral hypersensitivity, abnormal motility disturbances, and psychological disturbances.

There are four “pillars” that are important to consider when evaluating IBS:

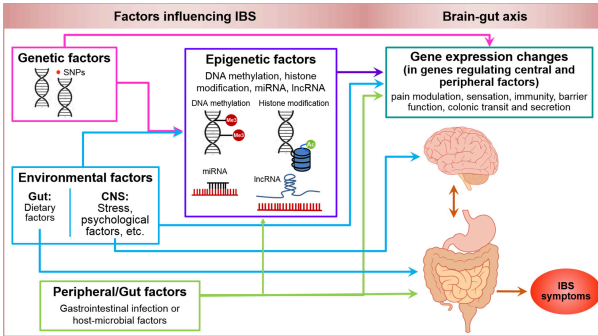
1. Diet
2. Psychological factors (e.g. anxiety, depression) and life stressors (e.g. divorce, family illness, financial difficulties, etc.)
3. Exercise
4. The microbiome (i.e. probiotic use).

The most common symptoms of IBS are chronic and recurring abdominal pain associated with abnormal bowel habits, categorized as:

- diarrhea (loose and frequent stools, IBS-D)
- constipation (hard and infrequent stools, IBS-C)

- both diarrhea and constipation (IBS-M)
- unspecified (IBS-U).

Some will only have excessive bloating or gas with normal BMs.



Genetic, epigenetic, environmental and peripheral factors in irritable bowel syndrome. Full text description is below.

Source: Mahurkar-Joshi S and Chang L (2020) Epigenetic Mechanisms in Irritable Bowel Syndrome. Front. Psychiatry 11:805. doi: 10.3389/fpsyt.2020.0805



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=309#h5p-71>

# Screening and Diagnosis of IBS

Diagnosis of IBS can be difficult as there are no biochemical, structural or physiological abnormalities demonstrated in individuals with IBS. Thus, the diagnosis of IBS is symptom-based and not globally standardized. It remains a diagnosis of exclusion.

Clients may receive various testing (e.g. blood tests, CT scans, colonoscopy). However, a colonoscopy and blood test would typically be used to rule out IBS.

Once other GI conditions have been ruled out, physicians may use the Rome IV criteria. This is also a valuable tool for dietitians when evaluating a client's symptoms. Under the Rome IV diagnostic criteria, a patient might have IBS if they experience recurrent **abdominal pain** symptoms:

- on average at least one day per week in the last three months
- that started at least six months ago
- associated with two or more of the following criteria
  - related to defecation
  - associated with a change in frequency of stool
  - associated with a change in form (appearance) of stool

However, the ROME criteria does not capture all IBS symptoms. As an example, some people only have gas or bloating (but severe and painful) without any bowel movement abnormalities. They may respond well to FODMAPs and/or probiotics (reviewed later in the content). It is important to utilize various screening methods in the case of IBS, in order to best help your client.

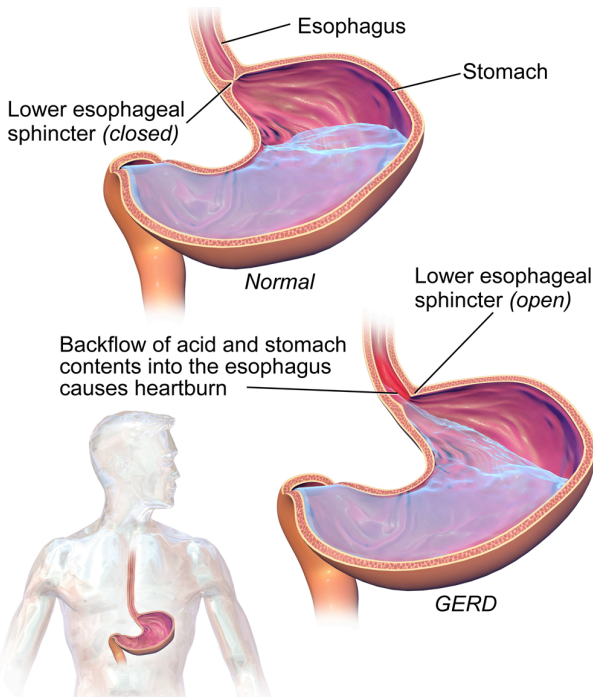
## Gastroesophageal Reflux Disease (GERD)

- Reflux is a normal physiological function. Problems arise with

increased occurrences of transitory lower esophageal relaxation with reflux of both gas and liquids leading to esophageal hypersensitivity.

- Inappropriate backflow of gastric contents (acid, bile, pepsin, pancreatic enzymes) into the esophagus or higher. These changes may result in reflux symptoms including heartburn, regurgitation, chest pain, hiccups, nausea, bolus sensation, chronic cough, trouble swallowing, and excessive mucous in the throat.
- It is important to distinguish between GERD: when acid repeatedly refluxes from the stomach into the esophagus; and laryngopharyngeal reflux (LPR): when stomach acid travels up the esophagus and spills into the pharynx or larynx. Treatment of these conditions does not differ largely, but it is important to have knowledge of the LPR symptoms in order to be able to distinguish between the differences. You should seek further details regarding the difference.
- Postulated causes of GERD may include transient lower esophageal sphincter (LES) relaxation or decreased LES tone, impaired esophageal clearance, delayed gastric emptying and decreased salivation.
- Reflux risk factors may include diets high in refined carbohydrates, increased gastric pressure, diabetes or eating disorders (i.e. can cause gastroparesis), hiatus hernia, smoking, medications, and certain conditions that affect esophageal motility.

It is important to have an understanding of these symptoms and risk factors when working with clients. However, often a referral or previous diagnosis of GERD will result in a client seeking counselling from a dietitian.



Patients with GERD have an opened lower esophageal sphincter and a backflow of acid and stomach contents into the esophagus, causing heartburn. Source: BruceBlaus, [CC BY-SA 4.0](https://creativecommons.org/licenses/by-sa/4.0/), via [Wikimedia Commons](https://commons.wikimedia.org/)

## Gastroesophageal Reflux Disease (GERD)

### Pharmacotherapy for Reflux

Those diagnosed with GERD are often on medications for reflux. The most common medications for reflux are Histamine 2 receptor blockers (H<sub>2</sub> Receptor Blockers) and proton pump inhibitors (PPI's). The table below describes these medications in more detail.

### Functions and examples of common reflux medications

Medication	Function	Common Examples
<b>Proton Pump Inhibitors (PPIs)</b>	Stop cells in the lining of the stomach from producing acid. They work by blocking a chemical system called the hydrogen-potassium adenosine triphosphatase enzyme system (otherwise known as the 'proton pump').	<ul style="list-style-type: none"> <li>• Esomeprazole (Nexium)</li> <li>• Lansoprazole (Prevacid)</li> <li>• Omeprazole (Prilosec)</li> </ul>
<b>Histamine 2 Receptor Blockers</b>	Block histamine-induced gastric acid secretion from the parietal cells of the gastric mucosa (lining of the stomach).	<ul style="list-style-type: none"> <li>• Famotidine (Pepcid)</li> <li>• Nizatidine (Axid)</li> <li>• Cimetidine (Tagamet)</li> </ul>

Of the patients who use PPIs:

- 10% do not respond to them
- 40% will get only partial resolution of symptoms
- 15-20% will get significant side effects
  - Short-term effects: nausea, gas, bloating, diarrhea, abdominal pain
  - Long-term effects: increased risk of impaired nutrient absorption, ability to kill bacteria, C-difficile, pneumonia

An important consideration when a client is receiving these medications is to assess for nutrient deficiencies associated with long-term use (i.e. over a year of prolonged use). These include vitamin B12, iron, magnesium and calcium. As a dietitian, you should evaluate laboratory values for these nutrients of concern and potentially recommend dietary strategies or supplements, if necessary.

Recent studies regarding the long-term use of PPI medications have noted other potential adverse effects including: pneumonia,

Clostridium difficile diarrhea, chronic kidney disease, risk of fractures, and dementia.

## Celiac Disease

Celiac disease (CD) is an autoimmune disorder that permanently affects the digestive system. CD is triggered in genetically susceptible individuals by the ingestion of gluten.

There are **three components** to CD:

1. The **genetic** factor is an individual's genes and the possibility of CD
2. The **environmental** factor is the exposure to gluten through diet
3. The **immunological** component is the immune reaction that causes injury to the small intestine

When a person with CD consumes foods that contain gluten, it causes an immunological reaction in the small intestine, which damages the interior of the small intestine known as the villi. Villi line the interior of the small intestine and once they become inflamed and essentially flattened from the reaction with gluten, malabsorption of the nutrients needed for good health occurs.

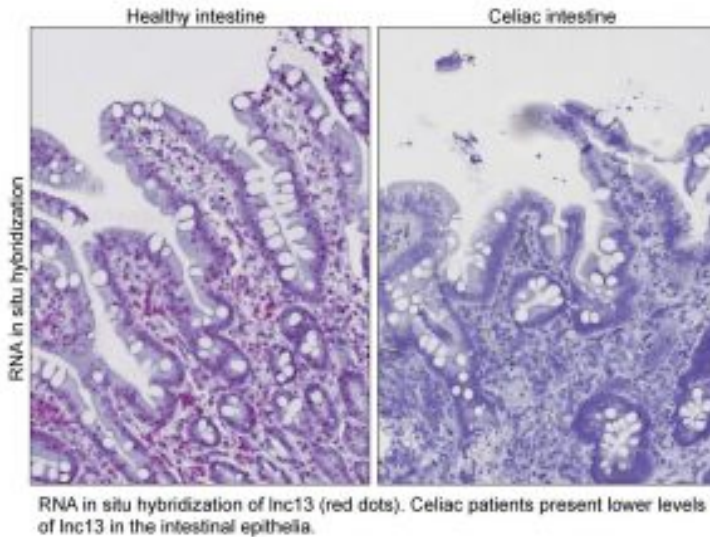
It is important to explain to clients that ingestion of gluten will cause damage to the small intestine, even if they are not having symptoms. As a result, the only treatment is lifelong adherence to a gluten-free diet.

You should also explore non-celiac gluten sensitivity (NCGS) and how it differs from CD.

# Screening and Diagnosis of CD

Diagnosis of CD can be difficult because of the broad range of symptoms that can vary from mild to severe. Although you may experience other screening tools, there are two **common screening tools** to be aware of:

1. **Serological Tests: IgA-tTG and IgA-EMA** are recognized as the most sensitive and specific serological tests for CD diagnosis. To obtain accurate test results it is imperative that serological tests be performed prior to eliminating gluten from the diet. There is a potential for false positives (especially for those with other autoimmune disorders) or false negatives (ranging approximately from 10-15%, which may be related to an IgA deficiency). You should explore and develop a further understanding of these tests. Positive serology in isolation is insufficient for diagnosis of celiac disease.
2. **Small Intestinal biopsy:** Currently the only definitive test and the gold standard for diagnosing CD is the small intestinal biopsy where cells or tissues are removed for examination of villous atrophy (damage of the villi in the small intestine). It is important that biopsies be taken prior to eliminating gluten from the diet as histological findings can begin to normalize upon initiation of a gluten free diet.



*Celiac patients present lower levels of Inc13 (red dots) in the intestinal epithelia*

Source: [Photo](#) by [Invited Researcher](#) is licensed under [CC BY-NC-ND 4.0](#)

It is important to understand that we are learning so much about celiac disease as the symptoms vary tremendously. For example, someone with severe symptoms could have a low IgA-tTG, while someone with a high IgA-tTG may have next to no symptoms and have trouble understanding their diagnosis. Based on clinical experience and expertise, you may notice that people will refuse testing because they have already started following a gluten-free diet, have had a relief of symptoms, and it is very painful to go back to eating gluten for the purposes of testing.

# Diverticulitis

**Diverticula** are small, bulging pouches that can form in the lining of the large intestine (most often in the lower part).

**Diverticulosis** is the presence of diverticula, and it is quite common as people age. According to [figures from the United States National Institute of Health](#), diverticulosis is experienced by more than 30% of adults aged 50-59 and more than 70% of adults aged 80 and older.

*The brief video below (1:24) demonstrates diverticulosis during a colonoscopy.*

<https://www.youtube.com/watch?v=ThuBZxbLo9g>

**Diverticulitis** is a condition that occurs when one or more of the diverticula pouches become inflamed, and in some cases infected. Diverticulitis can cause severe abdominal pain, fever, nausea and a marked change in bowel habits.

- **Risk Factors:** aging, obesity, smoking, lack of exercise, diet high in animal fat or low in fiber
- **Symptoms:** pain, nausea, vomiting, fever, constipation, blood or mucus in stool
- **Treatments:** often focused on prevention (e.g. high fiber diet, fiber supplements, medicines, probiotics)
- **Diagnosis:** CT scan or colonoscopy

Management of diverticulitis is controversial as a result of limited evidence. This will be explained in more detail during the “Plan” section.

Background complete! Feel free to review any resources and move to the next section, “Assess”, when you are ready.



# Assess



## Gathering Data for An Assessment

Before asking the patient questions for your assessment, make sure to introduce yourself and set the agenda for the discussion. When gathering data for your assessment, collect information on the patient's:

1. Clinical Data: medical, social/lifestyle, and GI histories
2. Anthropometric Data
3. Biochemical Data
4. Dietary Data

### Case Study: Meet Christian

In the case study used throughout this section, you are a Registered Dietitian at a Family Health Team. The client you are assessing is a 32 year old male named Christian Haggar.



*Christian Haggar, your client*

## Clinical Data

### Medical History

When gathering clinical data, consider the following details.

- **Type and duration of diagnosis:** Do they have a diagnosis? What has their family doctor discussed with them? If they do not have a specific diagnosis, what concern are they seeing you for? Do they regularly see any specialists?
- **Previous tests or procedures:** Have they had a scope, motility tests, or breath tests? What was the result?
- **Family's medical history:** Did members of their family have the same diagnosis or other medical conditions?

- **Other medical conditions they may have:** e.g. hypertension, dyslipidemia, cardiovascular disease, schizophrenia, depression, bipolar disorder, polycystic ovary syndrome (PCOS), sleep apnea, etc. Consider overlap or controversies of recommendations.
- **Symptoms and complications:** What are their symptoms? How is it affecting their quality of life? Do they notice any links between symptoms and dietary choices or behaviour?
- **Medications and supplements:** Are they on any related medications? Are they taking any supplements (Metamucil, probiotics, vitamins, etc.)?

## Christian's Medical History

- **Diagnosis:**
  - GERD – diagnosed 8 years ago. Through your discussion, Christian tells you he recently noticed his symptoms worsening and the doctor prescribed him medication.
  - IBS – diagnosed 1 month ago. Christian reports this is the main reason he is seeing you today.
- **Family's medical history:** Type 2 diabetes.
- **Medications and supplements:**
  - 20 mg **OD** Esomeprazole (Nexium) – started 4 weeks ago

- Metamucil – as directed once daily
- 1000 IU vitamin D once daily

## Social and Lifestyle History

When gathering social and lifestyle data, consider the following details.

- **Housing:** What is their living situation? Do they live with others/have a support system?
- **Employment:** Are they currently working? What do they do for work? Is it stressful? What does a typical day look like?
- **Income:** What is their main source of income? Do they have medical coverage?
- **Substance use:** Smoking? Alcohol? Any other substances?
- **Food security:** Can start with “where do you get your groceries”. More specific food security questions may include “Have anyone in your household gone without food in the past month because they couldn’t afford it?”
- **Physical activity:** Do they exercise? What is their routine Do they have an injury or live in an unsafe area making it difficult to get outside to exercise?
- **Stress:** How would they rank their stress? How does stress affect them?
- **Sleep:** How long do they sleep for? How is their quality of sleep?

## Christian's Social and Lifestyle History

- **Housing:** Lives with his fiancée, Caitlyn.
- **Employment:** Christian is a lawyer and his fiancée works in sales.
- **Income:** Has medical coverage for his medication.
- **Substance use:** does not smoke, drinks 1-2 glasses of red wine per night
- **Food security:** reports no concerns. Caitlyn is doing most of the groceries and cooking since Christian has been busier with work.
- **Physical activity:** typically goes to the gym 2 times per week for an hour (~120 mins per week on average). He finds enjoyment in exercise and it helps him relax. He tries to get outside to do activities when weather and time permit.
- **Stress:** He reports his job as being stressful (long hours, limited breaks).
- **Sleep:** 5-6 hours per night. His sleep quality is not great, attributed to the stress of his job and planning for his and Caitlyn's upcoming wedding.

## GI History

You should always ask a new client a few basic GI-related questions

(e.g. do you have any concerns regarding your digestion? do you have normal bowel movements?). However, if you are working with a client that is seeing you for a specific GI-related concern, it is important to ask more specific questions, which may include, but are not limited to the following:

1. **Do you see any GI specialists?** What has your family doctor talked to you about regarding your symptoms? Have you had any testing done for your concerns? What were the results (if you do not have access to this information in your practice)?
2. **What are your symptoms?** Any pain, vomiting, nausea, bloating, or gas? How often do your symptoms occur? Where are your symptoms (i.e. lower left side)?
3. **When did the symptoms start?** Did you notice any triggers?
4. **How are your bowel movements?** Have you noticed any mucous, greasy lining or blood in your stool? What is the consistency? Note: you should explore what these symptoms may suggest and why you should ask about them.
5. **Do you keep a journal of your symptoms?** Have you noticed any common triggers for your symptoms (what you eat, your environment, how you feel that day)?

## Christian's GI History

As the dietitian, you have asked Christian about his previous testing, his symptoms, bowel movements, and if he has any known 'triggers' for his symptoms. Review Christian's GI history in detail, as it needs to be considered during the plan section.

- **Testing:** Christian reports being tested by his family doctor for various GI diseases. He had an upper endoscopy, which resulted in his GERD diagnosis. He has completed blood work, a CT scan, and a colonoscopy over the past 6-months to a year related to his new symptoms. There were no findings. The doctor diagnosed him with IBS 1 month ago.
- **Symptoms:** Regarding his GERD, he experienced an improvement while on the medications (previous symptoms included heartburn, regurgitation, and hiccups), but reports increased bloating as side effects since starting the medication. He would like to control his reflux symptoms without medication as he was made aware of the long-term effects related to the use. Regarding his IBS, he reports pain in his entire abdomen approximately 15 minutes after eating (if he experiences symptoms), which occurs 3-5 times per week. This is followed by diarrhea, which does help relieve the pain. Over the past year, he has noticed that he goes to the bathroom more often, experiences a "urgency" sensation and has more "diarrhea".
- **Bowel movements:** Normally stool is soft but formed, unless he is having these mentioned symptoms, in which case it is watery and loose. He reports rectal pressure and pain with bowel movements due to an anal fissure. Every time there is increased pressure and pain, there is also bright red blood in the stool due to the fissure. No reports of mucous or greasy lining in stool. He goes to the bathroom once a day on average, but when experiencing symptoms it may increase.

- **Triggers:** No known triggers. Christian enjoys eating various foods (i.e. does not eat the same thing every day) and eating out. He has never kept a food journal.

## Anthropometric Data

When gathering anthropometric data from the client, consider the following details.

- **Weight:** Current weight in kg
- **Waist Circumference:** Current waist circumference in cm.
- **Height:** Current height in cm
- **Body Mass Index (BMI)**
- **Weight History:** Has their weight recently fluctuated? What was their highest and lowest adult body weight?

It's important to ask if the client is comfortable having these measurements taken as this may trigger stress for some clients. If you feel it is relevant, you should approach the conversation in a respectful manner and be cautious not to offend your client. If the client states that weight loss is a goal for them, it can be helpful to know:

- Why that goal is important for them
- If they have tried to lose weight before
- Any diets they have tried in the past
- How their weight has fluctuated over the years

## Christian's Anthropometric Data

- **Weight** = 74 kg
- **Height** = 183.5 cm
- **BMI** = 22 kg/m<sup>2</sup>
- **Weight History:** He has no concerns about his weight, which has remained stable throughout his life. He has never tried any diets. Christian considers his food choices healthy.

Since Christian did not indicate that weight was a concern, weight should not be focused on during education and recommendations as it does not align with the client's goals or needs.

## Biochemical Data

It is important to review any available lab work, even if it is not directly related to the condition or concern that your client is seeing you for.

## Christian's Biochemical Data

Here are the lab values for Christian. These labs are from one month ago. This is the information you have available to you based on his recent lab work.

### Christian's lab test results

Lab Test	Lab Result	Target Range
A1C	4.5%	< 5.7%
TC	3.1 mmol/L	< 4.0 mmol/L
LDL	1.45 mmol/L	< 2.0 mmol/L
HDL	1.9 mmol/L	> 1.0 mmol/L
TG	1.0 mmol/L	< 1.7 mmol/L
Serum iron	55 mcg/dL	60 - 170 mcg/dL
Serum ferritin	19 mcg/L	< 15 ug/L - iron deficiency 15-30 ug/L- probable iron deficiency >30 ug/L - iron deficiency unlikely >100 ug/L - normal iron stores
Vitamin B12	230 ng/mL	230 - 900 ng/mL
Folate	7 ng/mL	>8.7 ng/mL

As Christian is your client, it is important to review any available lab work, even if it is not directly related to the condition or concern (e.g. note the A1C value, as he mentioned a family history of type 2 diabetes).

While reviewing Christian's laboratory data, you recall him mentioning that he is extremely tired and experiences headaches and lightheadedness. Christian reports that he has attributed this to his lack of sleep, stress of wedding

planning, and busy work schedule. Review Christian's labs and make note of any concerns you may have. This information will be used in the plan section.

## Dietary Data

When gathering dietary data, consider the following details.

- **Diet History:** 24-hour recall, 3-day food record, and/or food frequency questionnaire (pop, juice, sweets, alcohol, fast food, etc.) Have they tried any diets in the past?
- **Eating behaviours:** How many meals/day? What times of the day are meals and snacks (i.e. evaluate time intervals)? Eating at home or eating out?
- **Food access and skills:** Do they have access to a kitchen? Do they get groceries and/or cook at home, or does someone else do the cooking in the household? What is their previous nutrition education? What do they know about managing their symptoms or condition with diet choices?

## Christian's Dietary Data

### **Eating behaviour:**

- Eats 3 meals a day. If he has a snack, it would be at night before bed.
- Eats out 3-4 times a week. Common places include Freshii (salads and rice bowls), ramen noodles, and Greek food.
- Eats at work for lunch, and has started packing dinners to bring to work most of the week as well

### **Food access and skills:**

- Does some grocery shopping and cooking.
- Reports enjoying a variety of healthy foods and believes he maintains a balanced diet.
- Has not received any nutrition education for his concerns

### **Diet history:** no dieting in the past.

Christian's 24-hour diet recall provides a picture of what he had to eat and drink the day before. You ask him if this represents a typical day. Christian confirms that these meals are representative of a typical day.

### Christian's 24-hour diet recall

Meal	Christian's diet recall
Breakfast 6 am	Fruit smoothie (strawberries, apple, avocado, kale, cucumber, almond milk), 2 hard boiled egg or "egg muffins" with spinach mixed in, and 1 large coffee with 2 cream (5%)
Lunch 12 pm	Premade salad or rice bowl (spring mix or brown rice, marinated or spiced baked chicken, cucumber, tomato, green pepper, onion, chick peas or kidney beans, walnuts, and feta or goat cheese with an olive oil dressing or any "light" dressing available), 1 large coffee with 2 cream (5%)
Dinner 5 pm	6 oz baked fish, chicken, or beef, with mixed roasted vegetables (broccoli, cauliflower, asparagus, potatoes cooked in olive oil with garlic, paprika, and other spices), and 1 cup of quinoa, rice, or whole grain pasta
HS snack 11 pm	1-2 glasses of red wine, 1-2 cookies or 2 cups of popcorn or carrots with red pepper hummus

Review his 24-hour recall and identify any concerns you may have considering his diagnosis of IBS and GERD, as this will be used in the Plan section.

PART 1: ASSESS COMPLETE. Please take a few minutes to think about the assessment strategies discussed and data collected. When you're ready, move on to Part 2: Plan.

# Plan



## Common PES Statement Terminology

As you interpret the dietary data from the assessment, you can form Problem, Etiology, Symptoms (PES) statements or nutrition diagnoses that help identify nutrition concerns that need to be addressed in your plan. If you are not familiar with how to write a PES statement please review this [resource from the Academy of Nutrition and Dietetics](#).

Here are some common nutrition problems that clients may experience:

- Excessive energy intake
- Not ready for diet/lifestyle change
- Inappropriate intake of types of carbohydrate
- Inappropriate intake of types of fats
- Limited food acceptance
- Inadequate vitamin/mineral intake
- Inadequate fiber intake
- Food- and nutrition-related knowledge deficit
- Physical inactivity
- Unintended weight loss
- Altered nutrition-related laboratory values (specify)
- Disordered eating pattern
- Inability to manage self-care

- Impaired ability to prepare foods/meals
- Limited adherence to recommendations

## PES Statements for Christian

Here is a brief list of potential PES statements for Christian. At this stage, the problem is mostly related to a lack of nutrition education in the past and a willingness to make changes.

1. Food and nutrition related knowledge deficit related to a lack of previous disease specific education from a dietitian as evidenced by client report and dietary/lifestyle history.
2. Not ready for diet changes related to a lack of desire to remove “trigger” foods as evidenced by clients resistance to remove coffee and alcohol from diet to relieve IBS and GERD symptoms.
3. Inappropriate food intake related to knowledge deficit as evidenced by the consistent consumption of traditional “trigger” foods for GERD and IBS (tomatoes, onions, garlic, spices, caffeine, alcohol).
4. Inadequate physical activity as evidenced by client report (under 150 minutes per week guideline).

# Management of GERD

Counsel the client on dietary and lifestyle triggers for GERD, and build a strategy to manage them closely for 2-4 weeks. Reintroduce foods as tolerated and depending on symptoms. Please note that triggers may vary, and restrictive diets may not be appropriate for all individuals.

## Christian's Medication and Laboratory Values

As previously mentioned in the Assess stage, Christian was experiencing heartburn, regurgitation, and hiccups before starting his medication. Christian hopes to reduce or remove the medication entirely, so it is important to provide him with education and strategies for the relief of symptoms.

When considering Christian's management for GERD, it is also important to consider the potential adverse effects of his medications.

We know the following about Christian:

- He has been taking Nexium (a proton pump inhibitor) for his GERD for 4 weeks
- He has low serum iron and ferritin and is on the low-normal range for vitamin B12.
- He reports that he experiences extreme fatigue,

headaches, and lightheadedness. Although these symptoms may be attributed in part to other lifestyle factors, you should consider his laboratory values in the context of these symptoms (as they are common).

As **vitamin B12 and iron are nutrients of concern when taking proton pump inhibitors (PPI's) for extended periods of time**, it is important to consider that Christian already has low laboratory values.

Consider the recommendation of an iron and vitamin B12 supplement, if it is appropriate and aligns with your clients needs. You may or may not consult with the interdisciplinary team regarding supplementation (it is not necessary, but you may want to in some cases depending on the client and care plan).

## Dietary Strategies

These are dietary strategies to help individuals manage their GERD symptoms:

- **Avoid foods that increase gastric pressure:** e.g. anything carbonated.
- **Avoid foods that relax the Lower Esophageal Sphincter (LES):** e.g. hot sauce, mints (spearmint, peppermint), fried foods, fatty foods, spicy foods, chocolate, caffeine, and alcohol.
- **Eat smaller meals throughout the day:** 5 – 6 meals is ideal. Large meals take a longer time to empty from the stomach, exerting pressure on the LES.
- **Slow your eating and drinking:** Eat and drink slowly, and chew

foods well. Do not use straws or chew gum.

- **Avoid foods and beverages below pH 4:** In some cases, symptoms can be managed through avoiding foods and beverages like pineapple, strawberries, coca cola, cognac, cranberry juice, and yellow mustard. You may obtain detailed lists for this.
- **Avoid other common triggers:** e.g. citrus fruits and juices, tomatoes, chocolate, onions, garlic, and spicy foods.

## Christian's Dietary Data: GERD Trigger Foods

In consideration of dietary recommendations for the management of GERD, it is important to highlight key foods that may be contributing to Christian's symptoms. In Christian's case, this is his first appointment with you. It is important not to overwhelm him with suggestions. Instead, focus on key "trigger foods" and "simple recommendations" such as swapping apples, tomatoes, onions, garlic (spices or seasoning) for other types of vegetables, and reducing caffeine and alcohol intake. Reducing consumption of these foods aligns with dietary management strategies for GERD.

**Christian's 24-hour diet recall**  
 [\*] indicates trigger foods for GERD

Meal	Christian's diet recall
Breakfast 6 am	Fruit smoothie (strawberries, <b>apple*</b> , avocado, kale, cucumber, almond milk), 2 hard boiled egg or "egg muffins" with spinach mixed in, and <b>1 large coffee with 2 cream (5%)*</b>
Lunch 12 pm	Premade salad or rice bowl (spring mix or brown rice, marinated or spiced baked chicken, cucumber, tomato, green pepper, onion, chick peas or kidney beans, walnuts, and feta or goat cheese with an olive oil dressing or any "light" dressing available), <b>1 large coffee with 2 cream (5%)*</b>
Dinner 5 pm	6 oz baked fish, chicken, or beef, with mixed roasted vegetables (broccoli, cauliflower, asparagus, potatoes cooked in olive oil with <b>garlic, paprika, and other spices*</b> ), and 1 cup of quinoa, rice, or whole grain pasta
HS snack 11 pm	<b>1-2 glasses of red wine*</b> , 1-2 cookies or 2 cups of popcorn or carrots with red pepper hummus

## Lifestyle Strategies

While it may not be a concern during an initial appointment, physical activity is an important lifestyle strategy and can be addressed at a follow-up.

Clients can be encouraged to complete:

- 150 minutes of moderate to vigorous aerobic exercise every week (e.g. 30 minutes, five days a week)
- Resistance exercises (like lifting weights) two to three times a week

In some cases, it may be beneficial to refer clients to the physiotherapist to be:

- Assessed for conditions that might place them at increased risk for an adverse event or injury during certain exercises
- Supervised by an exercise specialist for a certain period of time to ensure safety

In addition to being physically active, here are more lifestyle strategies to help individuals manage their GERD symptoms:

- Practice stress management
- Avoid alcohol or smoking
- Do not lie down for 2-3 hours after eating
- Try raising the head of your bed to avoid laying flat at night
- Avoid wearing tight clothing around your stomach and chest
- Maintain a healthy weight: Consider this strategy in the context of your client's history and goals. Many normal and underweight individuals experience GERD and it may not be the most crucial factor for your client. Always consider that weight is not a modifiable factor for everyone and may not be realistic for your client.

## Christian's Lifestyle Habits

In addition to reviewing dietary data, lifestyle habits play an important role in managing GERD and IBS. After you discuss with Christian, he provides you with the

information regarding his willingness to make changes to his lifestyle habits that may help relieve GERD symptoms.

Christian's lifestyle habits are listed here:

- Christian reports eating quickly during meals, especially during breakfast and lunch as his workdays are busy. After discussion, Christian will try to eat his meals slowly.
- Christian does not have time to take a “snack break” during the workday. After discussion, Christian prefers to eat three meals a day and does not want to worry about snacks.
- Christian reports sleeping from 12:00pm – 6:00am. After discussion, he recognizes that he should be sleeping more, which may help reduce his stress levels. He is willing to go to bed at 11:00pm.
- Christian reports wearing tight clothing (his business attire is a suit). After discussion, this is not negotiable.
- Christian exercises 2 times per week for 60 minutes, which does not meet the guidelines (~150 minutes per week). He is not currently interested in engaging in more physical activity. Since dietary concerns are of greater importance at this stage of his nutrition care, there is no physical activity plan at this time.

# Management of IBS

Elimination diets are often used for IBS. The **FODMAP** elimination diet (*which will be explained later on*) has a growing body of evidence but is still widely criticized. There are “traditional food triggers” that can be explored before using a restrictive or elimination diet, such as FODMAP. Using a FODMAP diet requires commitment and dedication for it to be effective, which may not be necessary.

It is up to the dietitian and client to determine the need for an intensive strategy, but it may be best to explore “traditional triggers first” using a food symptom journal.

## Food Symptom Journals

Keeping a food and symptom journal is critical to improving digestive symptoms. By consistently tracking multiple factors that relate to your digestive system, you can identify what may be triggering symptoms and truly relieve digestive symptoms.

During an initial appointment for IBS, it is important to provide a detailed explanation of the food symptom journal and the expectations for documenting. This will help the client understand and provide you with the best information for assessment, recommendations, and plans. Keeping a food symptom journal for 1-2 weeks before a follow-up appointment is often the first “plan of action.”

A food symptom journal can be kept in a table format, and should include the following headings:

- **Day and time:** what time of day you eat
- **Food and beverages:** exactly what you eat and drink (including condiments, sauces, and seasonings)
- **Environment:** where you are eating (homemade or outside)

food) and what's going on that day (e.g. stress levels, people around you, events, eating behaviors, etc.)








- **Symptoms and severity:** indicate symptom severity on a scale of 1 to 5. Often the client will choose 2-3 symptoms that are affected by the most and focus on those when recording; they can denote symptoms with a letter for ease of recording
- **Bowel movements:** indicate number and consistency according to the Bristol Stool Scale

## Bristol Stool Scale

The Bristol stool scale is a diagnostic tool that you can provide clients for explaining the appearance of their stool. The scale classifies stool into seven types, listed and depicted in the table and image below.

**Bristol Stool Scale**

Type	Description	Indication
<b>Type 1</b>	Separate hard lumps	Constipation (severe)
<b>Type 2</b>	Lumpy and sausage like	Constipation (mild)
<b>Type 3</b>	A sausage shape with cracks in the surface	Normal
<b>Type 4</b>	Like a smooth, soft sausage or snake	Normal
<b>Type 5</b>	Soft blobs with clear-cut edges	Lack of fibre
<b>Type 6</b>	Mushy consistency with ragged edges	Diarrhea (mild)
<b>Type 7</b>	Liquid consistency with no solid pieces	Diarrhea (sever)

BRISTOL STOOL CHART		
	Type 1 Separate hard lumps	<b>SEVERE CONSTIPATION</b>
	Type 2 Lumpy and sausage like	<b>MILD CONSTIPATION</b>
	Type 3 A sausage shape with cracks in the surface	<b>NORMAL</b>
	Type 4 Like a smooth, soft sausage or snake	<b>NORMAL</b>
	Type 5 Soft blobs with clear-cut edges	<b>LACKING FIBRE</b>
	Type 6 Mushy consistency with ragged edges	<b>MILD DIARRHEA</b>
	Type 7 Liquid consistency with no solid pieces	<b>SEVERE DIARRHEA</b>

Bristol Stool scale, with illustrations  
 Source: Cabot Health, [CC BY-SA 3.0](#), via [Wikimedia Commons](#)

## Traditional Trigger Foods and Beverages

This list can serve as a reference point for you and the client to identify common “trigger foods” and as a first step to resolve symptoms before consideration of an elimination diet (e.g. FODMAP).

- Avoid or limit caffeine and chocolate
- Avoid all preservatives and artificial flavours
- Avoid most raw fruits and vegetables
- Avoid wheat
- No alcohol
- No cabbage in any form (e.g. cauliflower, cabbage, broccoli, brussels sprouts)
- No corn or popcorn
- No onion or garlic
- No red meat or deli meats
- No spices (e.g. cinnamon, curry, chili powder, black pepper, cumin)
- No vinegars or anything fermented
- No whole seeds or nuts

Consider using a more comprehensive list during your practice.

## Christian's Dietary Data: IBS Trigger Foods

The plan for Christian's IBS is to start with him using a food symptom journal to track his patterns over the next 1-2 weeks. He will come back with a strong representation of his habits (both dietary and environment). Managing IBS is trial and error, with a combination of various strategies, so the more we know about the person, the better.

In the meantime you can start by identifying a few foods that are of concern from his dietary recall. The foods **bolded** in the chart are foods you may want to identify with Christian.

**Christian's 24-hour diet recall**  
 [\*] indicates trigger foods for IBS

Meal	Christian's diet recall
Breakfast 6 am	Fruit smoothie ( <b>strawberries*</b> , <b>apple*</b> , avocado, kale, cucumber, almond milk), 2 hard boiled egg or "egg muffins" with spinach mixed in, and <b>1 large coffee with 2 cream (5%)*</b>
Lunch 12 pm	Premade salad or rice bowl (spring mix or brown rice, <b>marinated or spiced*</b> baked chicken, cucumber, <b>tomato*</b> , green pepper, <b>onion*</b> , chick peas or <b>kidney beans, walnuts*</b> , and feta or goat cheese with an olive oil dressing or any "light" dressing available), <b>1 large coffee with 2 cream (5%)*</b>
Dinner 5 pm	6 oz baked fish, chicken, or beef, with mixed roasted vegetables ( <b>broccoli, cauliflower, asparagus*</b> , potatoes cooked in olive oil with <b>garlic, paprika, and other spices*</b> ), and 1 cup of quinoa, rice, or whole grain pasta
HS snack 11 pm	<b>1-2 glasses of red wine*</b> , 1-2 cookies or <b>2 cups of popcorn*</b> or carrots with <b>red pepper hummus*</b>

In Christian's case:

- You can create a plan together about foods he is willing to remove (even on a trial basis) to evaluate his symptoms.
- You can give him low-FODMAP alternatives (*which will be listed later on*) to replace these traditional trigger foods. Note that these recommendations are similar to the ones we created for GERD.
- It is reasonable to create nutrition recommendations for both GI concerns, as they compliment each other. But in other cases, too many changes or recommendations in an appointment may

become overwhelming and may not be appropriate.

- You are not going to start a FODMAP diet immediately because this is the first appointment and you should gather more information and try eliminating traditional triggers first

## FODMAP Diet

**FODMAP** is an acronym for:

- **F**ermentable
- **O**ligosaccharides (Fructans & Galacto-oligosaccharides)
- **D**isaccharides (Lactose)
- **M**onosaccharides (Fructose)
- **A**nd
- **P**olyols (Mannitol and Sorbitol)

These are short-chain carbohydrates that have been shown to increase water volume in the small intestine and be rapidly fermented in the large intestine. This leads to increased gas production and symptoms (i.e. pain, bloating, distension, flatulence, nausea and altered bowel motility). A low FODMAP diet restricts these short-chain carbohydrates.

A low FODMAP diet is the only focused elimination-type diet that is appropriate for IBS. Even if an individual is not pursuing a FODMAP diet, it is still important to understand FODMAPs and where they are found. You should seek further readings to review and become familiar with the common high FODMAP foods in each group.

## Caveats

The low FODMAP diet is considered to be a **second-line dietary strategy that can be pursued after:**

- Assessment
- Management of dietary and lifestyle factors
- Elimination of “traditional triggers”

**The long-term restriction of FODMAPs is not recommended.**

Briefly, recent research suggests that long term FODMAP restriction carries the risk of nutritional inadequacy, has the potential to foster disordered eating, and potentially unfavourable gut microbiota (although the impact is unknown).

Structured reintroduction of FODMAPs is recommended after six weeks to identify which FODMAPs an individual is sensitive to, identify assess tolerance to individual high FODMAP foods, promote food variety and support long-term self-management.

The key is to find and emphasize substitutions for foods that are eliminated (as they are triggers). This is to help clients make realistic and positive changes and reduce the fear and anxiety around consuming foods.

## Phase 1: Elimination

The FODMAP diet involves a three-phase approach. The first phase is “Elimination” focused on replacing foods high in FODMAPs with those lower in FODMAPs. It is very important to work with your client to ensure they are still eating a balanced diet.

Dietary strategies may include the following:

1. Avoiding foods that are substantial sources of fructans (e.g. wheat, rye, onions, garlic) and galactans (e.g. cabbage, certain

vegetables, legumes such as chickpeas).

2. Restricting lactose-containing foods (if lactose malabsorption intolerance is present).
3. Avoiding naturally-occurring and artificial polyols (e.g. stone fruits, and mushrooms, sugar-free chewing gum).

The following list acts as an example of information you may provide a client. This is not comprehensive, and if following a FODMAP diet, you will want to provide your client with a more detailed list.

**Foods high and low in FODMAP, by food category**

<b>Food Category</b>	<b>Avoid High FODMAP foods</b>	<b>Choose Low FODMAP foods</b>
<b>Vegetables</b>	<ul style="list-style-type: none"> <li>• Artichoke</li> <li>• Asparagus</li> <li>• Cauliflower</li> <li>• Garlic</li> <li>• Green peas</li> <li>• Leek</li> <li>• Mushrooms</li> <li>• Onion</li> <li>• Sugar snap peas</li> </ul>	<ul style="list-style-type: none"> <li>• Aubergine/eggplant</li> <li>• Bell pepper</li> <li>• Bok Choy</li> <li>• Broccoli</li> <li>• Carrot</li> <li>• Cucumber</li> <li>• Green beans</li> <li>• Kale</li> <li>• Lettuce</li> <li>• Potato</li> <li>• Tomato</li> <li>• Zucchini</li> </ul>
<b>Fruit</b>	<ul style="list-style-type: none"> <li>• Apples, apple juice</li> <li>• Cherries</li> <li>• Dried fruit</li> <li>• Mango</li> <li>• Nectarines</li> <li>• Peaches</li> <li>• Pears</li> </ul>	<ul style="list-style-type: none"> <li>• Blueberries (¼ cup)</li> <li>• Cantaloupe</li> <li>• Grapes</li> <li>• Kiwi</li> <li>• Mandarin</li> <li>• Orange</li> <li>• Pineapple</li> <li>• Raspberries (one-third cup)</li> </ul>
<b>Protein sources</b>	<ul style="list-style-type: none"> <li>• Cow's milk</li> <li>• Custard</li> <li>• Evaporated milk</li> <li>• Ice cream</li> <li>• Sweetened condensed milk</li> <li>• Soy beverage (made with soybeans)</li> <li>• Yogurt</li> <li>• Most legumes or pulses</li> </ul>	<ul style="list-style-type: none"> <li>• Almond milk</li> <li>• Brie and camembert cheese</li> <li>• Feta cheese</li> <li>• Hard cheeses</li> <li>• Lactose-free milk and yogurt</li> <li>• Soy beverage (made with soy protein)</li> <li>• Eggs</li> <li>• Firm tofu</li> <li>• Plain meats, poultry, seafood and fish</li> <li>• Tempeh</li> </ul>

<b>Grain products</b>	Wheat, rye, and barley-based products, including: <ul style="list-style-type: none"> <li>• breakfast cereals</li> <li>• cookies</li> <li>• crackers</li> <li>• snack products.</li> </ul>	<ul style="list-style-type: none"> <li>• Corn or quinoa flake</li> <li>• Oats</li> <li>• Quinoa or corn pasta</li> <li>• Rice</li> <li>• Rice noodles</li> <li>• Rice cakes</li> <li>• Sourdough spelt bread</li> </ul>
<b>Nuts and seeds</b>	<ul style="list-style-type: none"> <li>• Cashews</li> <li>• Pistachios</li> </ul>	<ul style="list-style-type: none"> <li>• Almonds (10)</li> <li>• Macadamia nuts</li> <li>• Peanuts</li> <li>• Pumpkin seeds</li> <li>• Sunflower seeds</li> <li>• Walnuts</li> </ul>

## Phase 2: Reintroduction

The goals of the reintroduction phase are to help:

- Increase variety and re-introduction of foods quickly
- Identify foods that do and do not trigger symptoms.

Clients can reintroduce each FODMAP category, one at a time, to determine which they can and which they cannot tolerate and in what amounts. Clients may choose to slowly reintroduce foods instead of following a strict challenge protocol. **It's up to the client and you.**

The idea is to introduce increasing serving sizes of a food high in just one FODMAP category to see if you experience symptoms. It is important to choose just one high FODMAP food in progressive serving sizes over 24 hours. The next food can be reintroduced after 48 hours, if feeling well.

If the client experiences no symptoms for either portion, they can add foods back during the “Personalization” phase.

## Phase 3: Personalization

Once the client has tested a variety of FODMAP categories and has a stronger clarity about individual trigger foods and/or portion sizes that are tolerable, the last step involves bringing FODMAP foods back into the diet to increase variety and nutritional quality.

At this stage, it is a balancing act between symptom management and enjoyment of food (sometimes symptom management instead of resolution is the result). It is also important to remember other factors that influence IBS symptoms, such as stress and environment.

The process for this personalization phase can be broken down into the following steps:

1. Add one high FODMAP food per day
2. Add another new FODMAP food the next day
3. If these foods (and portion sizes) do not trigger symptoms, keep including them in your diet.
4. If you experience symptoms, continue documenting in a food symptom journal to determine if this is a trigger food and return to regimen.

## Probiotics and Other Supplements

Probiotics are edible, living microorganisms that may be helpful in the management of IBS. There are many probiotic products available in different doses and variable bacterial strains. Many practitioners and clients have reported improvement of IBS symptoms with probiotic use.

In general, taking probiotics for IBS is considered safe, and if an individual finds four weeks of use of a probiotic is beneficial, they can continue to take it. This is a decision to be made between

the client and the dietitian, in consideration of a variety of factors (adherence, effectiveness, cost).

Individuals with IBS who choose to try probiotics should be aware that some products contain other ingredients that may increase IBS symptoms (e.g. dietary fibre: oats; FODMAPs: inulin, lactose, fructose, sorbitol and xylitol).

There is currently inadequate evidence to recommend any specific probiotic product independent of IBS-subtype (constipation or diarrhea or mixed predominant IBS)

The minimum concentration of bacteria typically recommended in probiotic supplements is 1 billion CFU per dose or higher. However, some research may demonstrate the effectiveness of a smaller dose for specific strains. Most probiotics range from 1 billion – 10 billion (with some up to 50 billion).

In addition to probiotics, here is a list of other IBS management supplements that clients may ask you about:

- Digestive Enzymes
- Prebiotics
- Apple Cider Vinegar
- IBGard (peppermint)
- Biocidin (herbal)
- Candibactin (herbal)
- Ginger

It is worthwhile to explore the evidence surrounding these supplements as you may receive questions about them in practice.

# Management of Celiac Disease

**Note:** This section of the Plan stage does not concern our client Christian, and is meant to provide you with an introductory overview of education for celiac disease.

Although celiac disease cannot be “cured”, it can be managed effectively by keeping a strict gluten-free diet.

To help manage a client’s celiac disease:

- Look out for nutrient deficiencies: iron (in 50% of diagnosed), vitamin D, folate, B12, B6, and zinc.
- Evaluate a client’s diet for nutrients of concern (as a result of a gluten-free diet and their dietary behaviours)
- Develop strategies to provide a balanced and nutrient dense diet.

It is important to overview the following with someone who is newly diagnosed with celiac disease:

- Cross-Contamination: Individuals with celiac disease should have their own cooking supplies, utensils and condiments.
- A general list of foods to avoid and foods to include: This is a starting point to get individuals familiar with gluten-containing foods in various categories. May consider using a phone “app” for scanning barcodes or eating at restaurants as lists can be overwhelming.
- Reading food labels: even though many food companies are highlighting “gluten-free” on labels, it is important that individuals know common and “hidden” ingredients to look for.

Review the list of gluten containing foods below



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=128#h5p-44>

## Management of Diverticulitis

**Note:** This section of the Plan stage does not concern our client Christian, and is meant to provide you with an introductory overview of education for diverticulitis.

## Preventing Diverticular Disease

Practice-based Evidence in Nutrition (PEN) suggests that the overall recommendations for the prevention of diverticular disease and acute diverticulitis are based on small amounts of low-quality evidence. However, **they provide the recommendations with caution as a result of limitations in evidence.**

Healthy lifestyle practices should be encouraged to prevent diverticular disease and acute diverticulitis. General recommendations include:

- Consuming a high fibre diet through dietary sources with or

without supplementation (e.g. up to 20 grams per day of supplementary fibre)

- A diet high in fruit, vegetables and whole grains
- Staying hydrated
- Being physically active
- Limiting intake of red meat
- Ensuring adequate vitamin D levels
- Limiting intake of alcohol consumption and not smoking (although no significant associations have been found)
- Avoiding nuts, corn, popcorn and fruit with small seeds (e.g. strawberries, blueberries) *in some cases*.
  - This applies mostly to those who experience an occurrence of acute diverticulitis, if they have worsening symptoms that may be related to the consumption of these foods (common triggers)
  - Assess this recommendation on a case-by-case basis

A recommendation regarding probiotics cannot be made at this time. However, there is emerging data to suggest the beneficial use of probiotics for diverticulitis. Given there are no contradictions for probiotics, you and your client would decide whether probiotics may be a part of their nutrition care plan.

## Managing Acute Diverticulitis

The dietary management of acute diverticulitis is different than preventing it. It is important that clients understand the difference.

If a client/patient is having a diverticular flare, they can:

1. Stick to a fluid-only diet for a few days until symptoms (i.e. pain) improve.
2. Eat a low insoluble fibre diet while recovering. Once symptoms resolve, patients can return to a high-fibre diet.

3. Receive antibiotics, as acute diverticulitis management is often accompanied by antibiotics

## Simulation Activity: Christian

To practice what you've learned about GERD and IBS management, complete the simulation activity below. After you complete the simulation, review a summary of Christian's nutrition care plan.



*An interactive H5P element has been excluded from this version of the text. You can view it online here:*

<https://pressbooks.library.torontomu.ca/dietmods/?p=128#h5p-62>

# Nutrition Care Plan Summary

## Christian's Nutrition Care Plan

Based on the details gathered prior to and during your initial appointment with Christian, here is a suggested nutrition care plan.

**Summary of recommendations for Christian's nutrition care plan**

<b>Area of Concern</b>	<b>Recommendations</b>
Medication and supplements	<ul style="list-style-type: none"> <li>• Continue taking Metamucil and vitamin D</li> <li>• Continue taking PPI. The goal is to implement dietary and lifestyle strategies to remove or wean off PPI's</li> <li>• Start taking iron and vitamin B12 supplements, as directed by RD. Start with B12 supplement and elimination diet. Add iron supplement 1-2 weeks after depending on clients preference. A "staggered" approach is used in consideration of side effects of supplementation (especially iron).</li> </ul>
GERD & IBS Management	<ul style="list-style-type: none"> <li>• Keep a food symptom journal for 1-2 weeks</li> <li>• Follow-up in 2 weeks to evaluate journal results and determine next steps</li> </ul>
Dietary choices	<ul style="list-style-type: none"> <li>• Continue eating foods that are high in fibre</li> <li>• Seek lactose-free alternatives to dairy milk</li> <li>• Reduce consumption of caffeine (to 1 coffee per day) and alcohol (to 1 drink every other day), as client is not comfortable with removing these entirely</li> <li>• Avoid other triggers in diet, including: tomatoes, onions, cabbages (incl. broccoli and cauliflower), garlic, and added spices</li> </ul>
Lifestyle habits	<ul style="list-style-type: none"> <li>• Continue to exercise 2 times per week for 1 hour; no changes required at this time</li> <li>• Go to sleep earlier (1 hour earlier than normal)</li> <li>• Eat meals and beverages slowly</li> </ul>

**PART 2: PLAN COMPLETE.** Please pause to reflect on the nutrition care plan we created for Christian. When you're ready, move on to Part 3: Implementation.

# Implement



## Interdisciplinary Team

When implementing your nutrition care plan, you may have to liaise with other members of the care team. You'll want to discuss the clients treatment plans, if you have a suggestion or document a new findings after your appointment with the client. You may consider asking the client if they would want to see a particular professional (such as a social worker), if you feel it may benefit their care or a concern that is outside of your scope of practice. Review the different professions listed below.

- **Physician or Nurse Practitioner:** Assess patient needs, order and interpret lab work, diagnose, and prescribe treatment plans.
- **Pharmacist:** Advise on safe and effective medication to use for specific conditions and respond to patients symptoms by managing medications and their interactions.
- **Social Worker:** Provide counselling and identify sources of emotional support for patients and their families to cope with diagnoses or life stressors.
- **Psychiatrist:** Provide counselling to assess both mental and physical aspects of psychological problems. Specializes in the diagnosis, prevention, and treatment of mental disorders.
- **Gastroenterologist:** Provide specific treatment and diagnosis of GI problems and diseases. First they will assess and consult

regarding the client. Often involved when exploring concerning symptoms or administrating testing. They may provide a diagnosis or opinion immediately, or order testing and bloodwork to determine a diagnosis.

## Liaising with Christian's Team

### Regarding supplements

Christian is concerned about his iron and B12 values and is experiencing symptoms affecting his quality of life (i.e. headaches, fatigue, lightheadedness). He is interested in starting to incorporate a supplement, in hopes that it will contribute to a relief of his symptoms. He is open to exploring ways to improve this with diet in future appointments (e.g. exploring iron-rich foods), but for now he is most interested in supplements.

To address Christian's concerns, you:

- Suggest the addition of an iron and vitamin B12 supplement
- Provide him with information on the potential GI side effects of iron (e.g. nausea, flatulence, abdominal pain, constipation, diarrhea, and black stools)
- Suggest updated lab work for Christian after 3-4 months (typical timeline) to reassess related lab values and the effectiveness of the supplement (i.e. is Christian lacking the appropriate amount of iron or is

there a possible absorption issue?)

In this case, you do not need to directly liaise with the team on initiation of these supplements, but you would note the addition of them to the clients care plan. If not already initiated, you may request that his physician provides a laboratory requisition (during the established timeframe) so that you can properly evaluate the use of the supplements on your clients values.

## Education

When implementing your plan with your client you may need to provide some education to them. When educating clients, try to:

- **Individualize the education as much as possible:** Discuss high-risk topic first since they are the priority, connect the client's goals to your plan, and focus on what they want to learn.
- **Find out if patient has had previous education:** Ask the client if any one else has talked to them, and adjust your education accordingly.
- **Focus on a few key messages:** If the client is newly diagnosed or doesn't know much about the management of GERD or IBS, try not to overwhelm them with too much information during your first couple of interactions. Instead give them a few small goals or suggestions to start.

Think of some key messages you might want to speak to Christian about when providing education.

## Christian's Education

Review the education statements below. These are examples of what you may speak with Christian about in regards to his nutrition care plan. However, you may have brainstormed additional statements outside of these.

**Key messages for education, by area of concern**

Area of Concern	Key Messages for Education
Medication and supplements	<ul style="list-style-type: none"> <li>Your vitamin B12 and iron laboratory values are low. The medication you are on for GERD puts you at risk for these nutrient deficiencies. You are also experiencing common symptoms associated with iron and B12 deficiency. Therefore, you may want to consider supplementation or dietary strategies.</li> </ul>
GERD & IBS Management	<ul style="list-style-type: none"> <li>For effective management of IBS and GERD, it is helpful for me to get a better representation of your dietary and lifestyle habits through a food symptom journal. Keep track of this for two weeks and try to provide as much detail as possible.</li> </ul>
Dietary choices	<ul style="list-style-type: none"> <li>Alcohol and caffeine may be contributing to your symptoms. Although you are not ready to remove this entirely, you can consider reducing consumption to evaluate symptoms or removing them on a 'trial' basis.</li> <li>Some of your food choices are known 'triggers' for IBS and GERD. This includes tomatoes, onions, garlic, and spices. Start with removing these foods for two weeks and track your symptoms.</li> </ul>
Lifestyle habits	<ul style="list-style-type: none"> <li>Stress plays a role in the management of IBS and GERD. Getting an extra hour of sleep could help reduce your stress and is good for your overall health.</li> <li>Consuming meals or beverages quickly can contribute to reflux symptoms. Try to slow down when you are eating your meals.</li> </ul>

# Supporting Change

[Prochaska and DiClemente's transtheoretical model](#) (also known as “stages of change”) can be a useful tool in assessing your client's willingness to change. These “stages” can be used during charting and PES statements. The five stages are listed below with corresponding statements:

1. **Precontemplation:** “I am not ready for change.”
2. **Contemplation:** “I am intending to make changes in the next 6 months.”
3. **Preparation:** “I am intending to make changes in the next month.”
4. **Action:** “I have made changes in the last month and continue to make changes.”
5. **Maintenance:** “I am managing my condition with my previous changes for more than 6 months.”

Ongoing management of a chronic disease can lead to burnout, and making dietary changes may be difficult for some clients. To help support them in making these changes, you may want to try:

- **Motivational interviewing:** collect their story, listen reflectively, collaborate rather than convince
- **SMART goal setting:** help to identify barriers to change as part of creating a nutrition care plan with the client
- **Referral to social worker:** consider referring them to a social worker if they need someone to talk to about coping with the burden of managing a chronic disease

Think about some SMART goals that you could set in collaboration with Christian.

## Christian's SMART Goals

Here are some SMART goals Christian could work on based on his diet history and our nutrition care plan. When making SMART goals, you can discuss potential barriers and strategies to overcome those barriers. It is important to make Christian feel motivated and confident that she can achieve these goals, but if he does not, that is something you can work on with him.

- I will go to bed at 11:00pm instead of 12:00am every night starting next Sunday.
- I will limit myself to one cup of coffee per day starting next Sunday.
- I will have one glass of red wine every other night instead of daily starting next Sunday.
- I will remove tomatoes, onions, garlic, cabbage, and spices from my diet for the next two weeks starting next Sunday.
- I will eat my lunch spread out over 30 minutes instead of 15 minutes starting next Sunday.
- I will keep a food journal documenting what I eat, drink, my environment, my symptoms and my bowel movements for two weeks starting next Sunday.

PART 3: IMPLEMENT COMPLETE. Pause to reflect on the implementation strategies discussed. When you're ready, move on to Part 4: Evaluation.

# Evaluate

## Evaluating the Nutrition Care Plan

It is important to evaluate all components of the nutrition care plan, as they each play an important role in motivation, adherence and success. Review the chart below for common follow-up questions to ask for each section. These questions are not comprehensive, they are meant to act as an example. Pause and consider other questions you may want to ask. Continue when you are ready.

**Questions to evaluate nutrition care plan effectiveness**

<b>Goals or Plans</b>	<b>Evaluate Effectiveness of NCP</b>
Medications and Supplements	<ul style="list-style-type: none"> <li>• Are they taking their medications and supplements?</li> <li>• Any concerns?</li> <li>• Updated lab work?</li> </ul>
GERD and IBS	<ul style="list-style-type: none"> <li>• How are their symptoms?</li> <li>• Have they noticed any changes?</li> </ul>
Food Journal	<ul style="list-style-type: none"> <li>• Did they document as requested?</li> <li>• Did they notice any “triggers” while documenting?</li> <li>• What is your evaluation of the food journal?</li> </ul>
SMART goals	<ul style="list-style-type: none"> <li>• Have they made the suggested diet and lifestyle changes?</li> <li>• Are there any barriers to changes?</li> <li>• Have they noticed any improvements as a result?</li> </ul>
Physical Activity	<ul style="list-style-type: none"> <li>• Do they want to revisit physical activity goals?</li> </ul>

## Evaluating Christian’s Nutrition Care Plan

Upon evaluation of Christian’s NCP, you receive the

following information on his outcomes. Pause and read through this information. Again, this is an example of basic information to collect. This would be more comprehensive in practice. Consider your next steps based on the information provided.

### Questions to evaluate nutrition care plan effectiveness

Goals or Plans	Outcome
Medications and Supplements	<ul style="list-style-type: none"> <li>• Taking medications and supplements as prescribed</li> </ul>
GERD and IBS	<ul style="list-style-type: none"> <li>• Noticed less GERD-related symptoms</li> <li>• No noticeable change in IBS symptoms</li> </ul>
Food Journal	<ul style="list-style-type: none"> <li>• Noticed onions as a reoccurring ‘trigger’ food</li> <li>• Noticed eating slower benefited reflux symptoms</li> <li>• On evaluation of journal, you recognize many other high FODMAP foods in his dietary patterns</li> </ul>
SMART goals	<ul style="list-style-type: none"> <li>• Had a difficult time reducing caffeine and alcohol consumption related to work and stress</li> <li>• Adhered to other SMART goals</li> </ul>
Physical Activity	<ul style="list-style-type: none"> <li>• Not interested in making physical activity goals.</li> </ul>

## Next Steps for Christian

- **Evaluate Christian's food journal in detail.** Highlight symptoms, frequency, and severity while evaluating associations with food or environment.
- **Continue with SMART goals.** Emphasize the importance of trying to remove all triggers (alcohol and caffeine) to assess tolerance.
- **Evaluate stage of change.** Tailor education and recommendations accordingly.
- **Make new SMART goals.** Ask Christian if he has identified any goals based on his education on the topic. For GERD and IBS, consider removal of new foods while adhering to the removal of previously identified foods.
- **Consider additional strategies,** such as FODMAP diet (if client wants too and is willing to adhere) or other supplements (probiotics).

## The Nutrition Care Process Model

As you use the Nutrition Care Process Model and the learning from this case study as a guide throughout your patient care in practicum, please keep in mind that the process is dynamic, and not step-by-step as all cases are different. You are encouraged to

complete the recommended readings for this module and continue to expand your learning in this clinical area of practice.

PART 4: EVALUATE COMPLETE. Pause to reflect on the evaluation strategies discussed, and review the readings and resources in the following section for your information.

You've now completed the nutrition for Outpatient GI module. Please consider providing feedback through the embedded form in the next section.

## Acknowledgements

Julia Stanislavskaia, MSc, RD

Michaela Kucab, MHSc (c), RD

# Feedback Form



*One or more interactive elements has been excluded  
from this version of the text. You can view them online*

here: [https://pressbooks.library.torontomu.ca/  
dietmods/?p=2244](https://pressbooks.library.torontomu.ca/dietmods/?p=2244)

# Reading List

The following is a list of readings and resources to help supplement your learning in this module topic.

## Readings

- Katz, Philip; Gerson, Lauren; Vela, Marcelo. [Guidelines for the Diagnosis and Management of Gastroesophageal Reflux Disease](#), American Journal of Gastroenterology: March 2013 – Volume 108 – Issue 3 – p 308-328. doi: 10.1038/ajg.2012.444.
- ESPEN practical guideline: [Clinical Nutrition in inflammatory bowel disease](#)
- Jeejeebhoy KN. [Short bowel syndrome: a nutritional and medical approach](#). CMAJ. 2002 May 14;166(10):1297-302. PMID: 12041848; PMCID: PMC111082.

## Additional Resources

- Alberta Health Services:
  - [Gluten-Free Diet](#)
  - [Managing Acid Reflux](#)
- Canadian Celiac Association – [Food Labelling](#)
- Canadian Digestive Health Association – [IBD Digital Toolkit for the Newly Diagnosed](#)
- Crohn's and Colitis Canada:
  - [Mental Health and Wellness](#)
  - [Ostomy 101 Webinar](#)

- [IBD Kitchen](#)



# ENTERAL NUTRITION

Welcome to the Enteral Nutrition section! Throughout this section, an inpatient case study will be used to enhance your learning and comprehension of enteral nutrition. You will learn what information to gather for your assessment, how to interpret that data to form a nutrition care plan, how to implement your patient's care plan, and what to look for when following-up and evaluating your plan. As you progress through the content, please keep in mind that the nutrition care process model used here is dynamic and not a linear, step-by-step process. The case study used here is an example, and not all cases will follow the same path.



[Doyle, G. R., McCutcheon, J. A. \(2015\). Clinical procedures for safer patient care. BCcampus. https://opentextbc.ca/clinicalskills/](https://opentextbc.ca/clinicalskills/)

# Learning Outcomes

By the end of the section you will be able to:

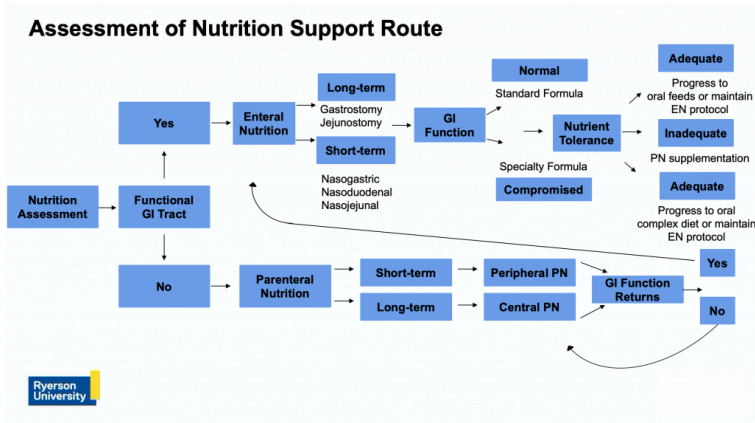
1. Identify indications, contradictions, and routes of support to determine the requirement for enteral nutrition.
2. Identify the routes, sites of delivery, and delivery methods of enteral nutrition.
3. Identify how to gather clinical, anthropometric, biochemical, and dietary data necessary to complete an enteral nutrition assessment.
4. Determine a patient's energy, protein, and fluid needs using data from the initial assessment.
5. Interpret biochemical values, including sodium, potassium, phosphorous, calcium, magnesium, albumin, BUN/urea, and creatinine.
6. Understand the role of the speech language pathologist and importance of their assessment for a patient with dysphagia.
7. Understand and identify refeeding syndrome risk for a patient and the management and evaluation procedures associated with preventing it.
8. Choose an appropriate enteral nutrition formula and plan for a patient.
9. Identify the complications of enteral nutrition and the appropriate management and monitoring procedures.
10. Understand the roles of the members of the interdisciplinary team, including the speech language pathologist, medical doctor, nurse practitioner, pharmacist, registered nurse, physiotherapist, occupational therapist and social worker.
11. Evaluate the nutrition care plan using assessment data relevant to the patient nutrition concerns, including malnutrition, symptom management, enteral nutrition changes, medications, supplements, and medical plan.

# Background

## Nutrition Support Routes

Nutrition support is the provision of enteral (EN) or parenteral nutrition (PN) to treat or prevent malnutrition. Nutrition support may be used to supplement oral intake. If the individual cannot eat, it can provide all of that individual's nutritional requirements.

A basic flow diagram for assessment of nutrition support is presented below. This flow diagram can be impacted by a variety of variables but is a good representation of how to assess for enteral or parenteral nutrition. In consideration of more complex patients, you should use this diagram as a starting point for an assessment, not a comprehensive tool for decision making.



Flow diagram of how to assess nutrition support route. A full text description of the steps are presented below .



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<https://pressbooks.library.torontomu.ca/dietmods/?p=369#h5p-50>

## Enteral Nutrition

Enteral Nutrition is liquid nutrition provided through the GI tract via a tube, catheter, or stoma. This is the recommended route of nutrition support for patients with functional GI tracts. If the gut works, use it!

EN is associated with reduced infectious complications, and helps to maintain:

- gut integrity (supports gut barrier function)
- normal digestive and absorptive capabilities
- gut-associated immune function

## Indications & Contraindications

**Indications** for enteral nutrition include a functional GI tract and clinical conditions in which oral intake is impossible, inadequate or unsafe.

Such clinical conditions include:

- Neurological disease/ dysfunction (e.g. stroke, dysphagia, head trauma, head and neck cancer, decreased level of

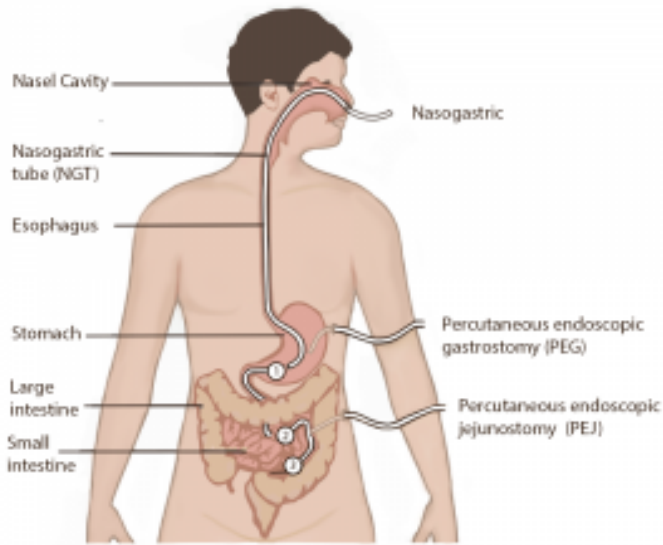
consciousness)

- Respiratory dysfunction (e.g. respiratory failure, mechanical ventilation)
- GI disease
  - Ileus or obstruction (feed distally)
  - Short bowel syndrome (>100 cm small bowel)
  - Low output enterocutaneous fistula (<500 mL per day)
  - Pancreatitis (small bowel feeding)

**Contraindications** for enteral nutrition include, but are not limited to:

- Non-operative mechanical GI obstruction
- Intractable vomiting/ diarrhea refractory to management
- Severe short bowel syndrome (<100 cm small bowel)
- Paralytic ileus
- Distal high output fistula (too distal to bypass with feeding tube)
- Severe GI bleed
- Severe GI malabsorption
- Cannot gain access to the GI tract
- Aggressive intervention not warranted/ desired

# Routes of Enteral Feeding



[“Types and Placement of Enteral Tubes.png”](#) by Meredith Pomietlo for Chippewa Valley Technical College is licensed under [CC BY 4.0](#)

Enteral feeding tubes may enter the body at several different sites. The choice of enteral feeding route depends on several factors, such as the intended duration of nutrition support, the patient’s condition, and any limitations to access (such as trauma or obstructions).

# Sites of Delivery

### Overview of enteral sites of delivery

Sites of delivery	Access types	Indications	Advantages	Disadvantages
<p><b>Gastric (stomach)</b></p>	<ul style="list-style-type: none"> <li>• Nasogastric (NGT)</li> <li>• Orogastric tube (OGT)</li> <li>• Percutaneous Endoscopic Gastrostomy (PEG)</li> <li>• Gastrostomy tube (G-Tube)</li> </ul>	<ul style="list-style-type: none"> <li>• Patients with normal emptying of gastric and duodenal contents</li> </ul>	<ul style="list-style-type: none"> <li>• Large reservoir capacity of the stomach</li> <li>• Maintains normal gut function</li> <li>• Most cost effective</li> <li>• Easiest to insert</li> <li>• PEG/G-Tube decreases the risk of tube displacement</li> <li>• Can give bolus feeds</li> </ul>	<ul style="list-style-type: none"> <li>• Increased risk of esophageal reflux and/ or pulmonary aspiration</li> <li>• NGT may result in discomfort for patient and tube displacement</li> <li>• PEG/ G-Tube increases risk of irritation and infection at insertion site</li> </ul>
<p><b>Duodenum (small bowel)</b></p>	<ul style="list-style-type: none"> <li>• Nasoduodenal tube (NDT)</li> <li>• Oroduodenal tube (ODT)</li> </ul>	<ul style="list-style-type: none"> <li>• Patients who have impaired gastric emptying or who are at risk of esophageal reflux</li> <li>• Normal intestinal function, need to bypass stomach</li> </ul>	<ul style="list-style-type: none"> <li>• Can be used for early enteral feeding</li> <li>• May reduce risk of esophageal reflux or pulmonary aspiration</li> </ul>	<ul style="list-style-type: none"> <li>• May require pump to control feed rate</li> <li>• May require fluoroscopic fibre-optic endoscopic placement of tube</li> <li>• Risk of displacement/migration back into stomach</li> <li>• No gastric barrier against bacteria</li> </ul>

<p><b>Jejunum (small bowel)</b></p>	<ul style="list-style-type: none"> <li>• Nasojejunal tube (NJT)</li> <li>• Jejunostomy tube (J-Tube)</li> <li>• Percutaneous Endoscopic Gastrostomy with jejunal extension (PEJ)</li> </ul>	<ul style="list-style-type: none"> <li>• Normal intestinal function, need bypass the stomach</li> <li>• Can bypass an upper GI surgical site, obstruction, pancreas</li> </ul>	<ul style="list-style-type: none"> <li>• Can be used for early enteral feeding</li> <li>• May improve tolerance to enteral feeding to meet nutritional requirements and avoid parenteral nutrition</li> </ul>	<ul style="list-style-type: none"> <li>• Potential gastrointestinal intolerance (bloating, cramping, diarrhea) due to lack of reservoir capacity</li> <li>• Requires a pump to control feed rate</li> <li>• May require fluoroscopic fibre-optic endoscopic placement of tube</li> <li>• Risk of displacement/migration back into stomach</li> <li>• No gastric acid barrier against bacteria</li> </ul>
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# Delivery Methods

**Overview of delivery methods, by feeding type**

<b>Type of Feeding</b>	<b>Explanation</b>	<b>Advantages</b>	<b>Disadvantages</b>
<b>Continuous Feeding</b>	<ul style="list-style-type: none"> <li>• Defined as feeding over 20-24 hours either by gravity drip or a feeding pump</li> <li>• Continuous feeding at a low volume is often used when starting an enteral feeding regime</li> <li>• It is the preferred method of delivery for GI intolerance, critical illness and some medical conditions</li> </ul>	<ul style="list-style-type: none"> <li>• Allows the lowest possible hourly feeding rate to meet nutrient requirements</li> <li>• Better gastrointestinal tolerance due to the low feeding rate</li> </ul>	<ul style="list-style-type: none"> <li>• Physical attachment to the feeding apparatus (may affect quality of life)</li> <li>• Expense of equipment (pump and giving sets)</li> </ul>

<p><b>Cyclic/ Intermittent Feeding</b></p>	<ul style="list-style-type: none"> <li>• Defined as feeding over 8-20 hours</li> <li>• Cyclic feeding involves continuous feeding over a shorter time period</li> <li>• Intermittent feeding involves breaks in continuous feeding administration i.e. being fed over 4 hours 3 times a day for a total of 12 hours.</li> <li>• Suitable for pump and gravity drip</li> </ul>	<ul style="list-style-type: none"> <li>• Allows freedom from feeding equipment (may improve quality of life)</li> <li>• Provides breaks for physical activity, movement, medication administration with drug-nutrient interactions, lying flat to sleep, and hunger/satiety to encourage oral intake if applicable.</li> <li>• Useful in the transition from continuous to bolus feeding, or from tube feeding to oral intake</li> </ul>	<ul style="list-style-type: none"> <li>• A higher infusion rate is required to provide the same volume of nutrition</li> <li>• Nutritional regimes may have a period of decreased tolerance as the patient adjusts to the new feeding rate</li> </ul>
<p><b>Bolus Feeding</b></p>	<ul style="list-style-type: none"> <li>• A prescribed volume of feed, administered in a shorter feeding time (such as 100-400ml over 15-60 minutes), which may be repeated in intervals to achieve the required volume</li> <li>• Usually fed into the stomach</li> </ul>	<ul style="list-style-type: none"> <li>• Physiologically resembles a more typical eating pattern promoting hunger/satiety</li> <li>• Allows greatest freedom from feeding equipment</li> <li>• Can be used to supplement oral intake</li> <li>• Can be more flexible to suit the patient's lifestyle and improve quality of life</li> </ul>	<ul style="list-style-type: none"> <li>• Large boluses may be poorly tolerated, especially in small bowel feeding</li> <li>• Some risk of aspiration, reflux, abdominal distension, diarrhea and nausea</li> </ul>

# Enteral Nutrition Assessment

When starting an enteral nutrition assessment, it is important to use a systematic process:

1. Complete a thorough nutrition assessment: past medical history, history of presenting illness, laboratory values, medications, nutrition history, anthropometrics, physical assessment, risk of refeeding syndrome, medical plan, and disposition.
2. Determine feeding access: gastric vs. small bowel (duodenal vs. jejunal); short term or long term.
3. Determine protein, energy, fluid requirements.
4. Check for other sources of nutrients: IV infusions or solutions, medications.
5. Formula selection
6. Determine appropriate delivery method: continuous, cyclic, intermittent, gravity, bolus.

Depending on your patient, you may need to consider other factors in your assessment. However, this is a general representation of the assessment process.

Background complete! Feel free to review any resources and move to the next section, “Assess”, when you are ready.

# Assess



## Gathering Data for Nutritional Assessment

Before asking the patient questions for your assessment, make sure to introduce yourself and set the agenda for the discussion.

You may review your patient's chart or obtain information from them directly. You will need to gather information on the following:

1. **Clinical Data:** past medical history, history of presenting illness (HPI), imaging, investigations, pathology, scheduled procedures, consultations, medical orders (medications, infusions), clinical documentation (fluids in and out, bowel movements, drains and tubes, vitals, and documentation of symptoms), medical plan, disposition plan
2. **Anthropometric Data:** weight, height, BMI, weight change, % weight change, % usual body weight, physical assessment, subjective global assessment.
3. **Nutritional Requirements:** energy, protein, and fluid
4. **Biochemical Data:** laboratory values (blood, urine, feces, sputum, tissue, wounds, drains etc.).
5. **Dietary Data:** current/ recent hospital diet order(s), current intake/ recent intake/ baseline intake, dietary restrictions, allergies/ intolerances, eating behaviours and patterns, calorie counts, supplements, previous nutrition/dietitian interventions.

The components reviewed in each section are common considerations but you may need to consider other factors depending on your patient.

## Subjective Global Assessment

According to the [Canadian Malnutrition Task Force](#):

Subjective global assessment (SGA) is the gold standard for diagnosing malnutrition. SGA is a simple bedside method used to diagnose malnutrition and identify those who would benefit from nutrition care. The assessment includes taking a history of recent intake, weight change, gastrointestinal symptoms and a clinical evaluation.

Use of the SGA varies among institutions. If you do not use the SGA, you can still follow the procedures for assessment by taking the history described above.

### Case Study: Meet Carson



*Carson Deluca, your patient*

Throughout this section's case study, you are a Registered Dietitian in General Surgery. The patient you are assessing is a 50 year old male named Carson.

## Clinical Data

Clinical data can include, but is not limited to:

- **Reason for visit:** hospital visit or RD consult.
- **Past medical history (PMHx):** health history to date.
- **History and presenting illness (HPI):** symptoms, surgeries, prognosis, tests (i.e. CT scan, ultrasound).
- **Current medical orders:** IV infusions, medications, consultations.
- **Clinical documentation:** Fluids intake (i.e. oral, IV, TPN/EN) and output (i.e. urine, vomit, bowel movements, drains (i.e.

catheter, chest tube, surgical site drain) and suctioning (i.e. oral secretions, OGT to straight drain), documentation of tubes (i.e. G-tube vs. NGT) and lines (i.e. PICC), vitals.

- **Medical care plan and disposition:** chemotherapy, radiation therapy, scheduled surgery, transfer to different floor, rehab facility, treatment facility, long term care, home.

## Carson's Clinical Data

Review Carson's clinical data. If you come across something you are not familiar with, such as a diagnosis or medication, pause and take the time to research it. Understanding all of the components of Carson's assessment is critical in understanding the case study and is good practice for your practicum. Take note of components that you think may be important for your enteral nutrition plan.

- **Age:** 50-year-old male
- **HPI:** 6-month history of progressive dysphagia, loss of appetite, and 25 pounds weight loss
- **Admission:** 2 weeks ago for worsening dysphagia, poor PO intake, and weakness
- **Investigations:** CT of neck/abdomen, OGD scope with biopsy
- **Pathology:** Esophageal cancer (squamous cell carcinoma)
- **Operations/ Procedures:** partial esophagectomy

with primary anastomosis and tumor removal. Gastrostomy tube placed intraoperatively – suspected poor swallowing function post operatively and during the course of chemotherapy and radiation therapy treatment.

- **Consultations:** Speech Language Pathology (SLP) for videofluoroscopic swallowing study, RD for initiation of EN via G-tube, medical oncology for assessment of chemotherapy and radiation therapy
- **Medications via G-tube:** Levothyroxine 0.25 mcg @ **0600h**, Sodium Phosphate 9 mmol × 1 dose, Hydromorphone control release 3 mg **q** 8 hours, Docusate sodium 100 mg BID, Sennosides 17.2 mg @ **HS**, Magnesium Hydroxide 30 ml @ **HS**, Potassium Chloride Liquid 40 mmol BID × 2 days, PRN dimenhydrinate 25-50 mg q4hrs
- **Infusions:** IV  $\frac{2}{3}$  +  $\frac{1}{3}$  @ 75mL/hr = 1800 mL per day (while **NPO**)
- **Medical plan:** chemotherapy + radiation therapy (outpatient)
- **Disposition plan:** home with home care supports once stable on enteral feeds

# Assessments of Swallowing

Speech-language pathologists (SLP) are concerned with the identification, assessment, treatment, rehabilitation and prevention of communication and/or swallowing disorders.

Videofluoroscopic Swallowing Study (VFSS) is a radiographic procedure that provides a direct, dynamic view of oral, pharyngeal, and upper esophageal function during swallowing. During this procedure, the SLP presents various food and liquid consistencies mixed with barium. The barium is necessary to view structures via videofluoroscopy during the swallow.

The VFSS allows the SLP to assess if food goes into the airway instead of the stomach (aspiration), which part of the swallow is affected, which food and liquid consistencies are safest to swallow, and if certain positions or strategies improve the swallow.



*Fluoroscopic image of a barium swallow*

Source: [Dr. Ian Bickle](#) via [Radiopaedia](#)

## Carson's VFSS Results

Carson has progressive dysphagia. The VFSS revealed overt aspiration and inability to clear residue from his oral cavity.

The SLP recommends that Carson remain **NPO** with an alternate form of nutrition (i.e. EN).

## Nutrition in Dysphagia Management

Dysphagia is the medical term for swallowing difficulties. For more information about dysphagia and its causes, read this [“Dysphagia 101” resource from Nestle Health Science](#).

The epiglottis muscle is responsible for making sure food or drinks go down your esophagus into the stomach (avoiding the airway). Normally, the airway should close as foods or liquids enter the throat to make sure a swallow is successful. Often, for people with dysphagia, this function can be impaired, leading to food or liquid going into the airway; this is a safety concern for aspiration.

To manage dysphagia, an SLP will complete an assessment and determine the safest dysphagia diet (liquid consistency, food texture, or NPO). Thickened beverages and texture-modified foods may help with swallowing safety by improving control and slowing down the movement of boluses in the mouth and throat. This gives

more time to close off the airway so the liquids can travel down the esophagus to the stomach.

The tables below provide an overview of food and drink consistencies for those with ranging degrees of dysphagia, and are based on information from the International Dysphagia Diet Standardisation Initiative (IDDSI).

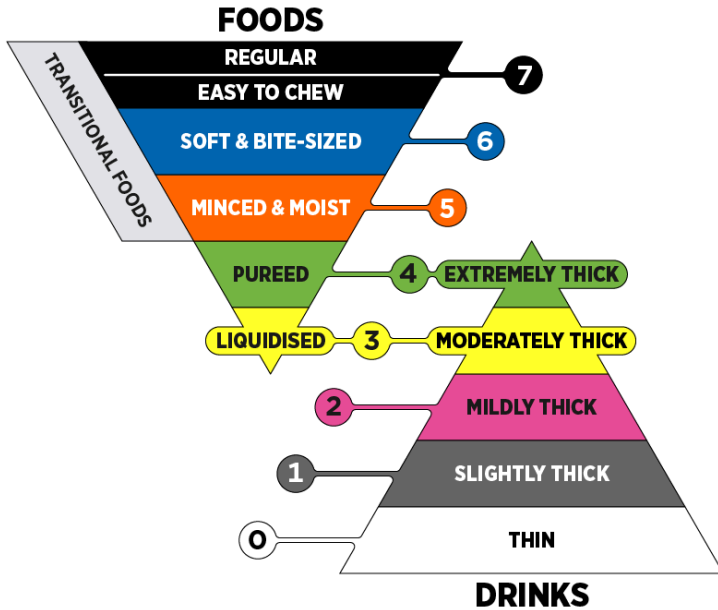
**Overview of drink consistencies, adapted from [IDDSI framework definitions \(PDF\)](#)**

<b>Drink Consistencies</b>	<b>Description</b>
<b>Thin</b>	Flows like water, fast flow, can drink through any type of cup or straw.
<b>Mildly Thick</b>	Nectar-like. Can be eaten with a fork or spoon. Can be scooped and shaped on a plate. Soft and moist with no separate liquid. Small lumps visible within the food which are easy to squash with your tongue. Biting is not required. Minimal chewing is required.
<b>Moderately Thick</b>	Honey-like. Can be consumed from a cup. Moderate effort is required to suck through a straw. Can be eaten with a spoon. No oral processing or chewing required.
<b>Extremely thick</b>	Pudding-like. Usually eaten with a spoon. Cannot be consumed from a cup because it does not flow easily. Cannot be sucked through a straw. Does not require chewing.

**Overview of food consistencies, adapted from IDDSI framework definitions**

<b>Food Consistencies</b>	<b>Description</b>
<b>Pureed</b>	Pureed foods are equivalent in terms of consistency to pudding-like or extremely thick liquids. Does not require chewing. Falls off spoon in a single spoonful when tilted and continues to hold shape on a plate. No lumps. Not sticky. Liquid must not separate from solid.
<b>Minced &amp; moist</b>	Can be eaten with a fork or spoon. Can be scooped and shaped on a plate. Soft and moist with no separate liquid. Small lumps visible within the food which are easy to squash with your tongue. Biting is not required. Minimal chewing is required.
<b>Soft &amp; bite-sized</b>	Can be eaten with a fork, spoon or chopsticks. Can be mashed/broken down with pressure from fork, spoon or chopsticks. A knife is not required to cut this food. Soft, tender and moist throughout but with no separate liquid. Chewing is required before swallowing.
<b>Regular</b>	Foods of various textures. Any method may be used to eat these foods. Foods may be hard and crunchy or naturally soft. Includes hard, tough, chewy, fibrous, stringy, dry, crispy, crunchy, or crumbly bits. Includes 'dual consistency' or 'mixed consistency' foods and liquids.

Depending on your hospital or clinic, you may encounter IDDSI terminology and standardization. The [IDDSI Framework](#) provides common terminology to describe food textures and drink thickness. IDDSI tests are intended to confirm the flow or textural characteristics of a product at the time of testing.



The IDDSI Framework provides a common terminology for describing food textures and drink thicknesses to improve safety for individuals with swallowing difficulties. Full text description is below.

Source: © [The International Dysphagia Diet Standardisation Initiative 2019](#). Licensed under [CC-BY-SA 4.0](#). Derivative works extending beyond language translation are not permitted.



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=136#h5p-70>

# Anthropometric Data

## Assessment of Body Weight

Body weight is the most used indicator of nutritional status, as it is used for calculating fluid, protein, and energy requirements.

Obtaining height and age is often necessary to further interpret body weight. Body Mass Index (BMI) is commonly used as a classification to evaluate health risk, as demonstrated in the table below. Master's tables are used for adults aged 65+.

It is important to consider if the weight you are using needs to be adjusted for fluid retention or if the patient has an amputation. For the most accurate estimations, using a weight as close to a “dry weight” is best.

**Health risk classification, according to Body Mass Index (BMI)**  
**BMI = weight (in kg) divided by height (in m<sup>2</sup>)**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

Classification	BMI Category (kg/m <sup>2</sup> )	Risk of Developing Health Problems
Underweight	<18.5	Increased
Normal weight	18.5-24.9	Least
Overweight	25.0-29.9	Increased
Obese class I	30.0-34.9	High
Obese class II	35.0-39.9	Very high
Obese class III	>40.0	Extremely high

It is also important to use other markers of weight, including % weight change and % usual body weight during your assessment to further evaluate your patient's weight. The calculations in the tables

below will help you interpret the findings in regard to severity and indication of malnutrition.

**% of weight loss, by time frame and severity**  
 $\% \text{ weight loss} = (\text{usual body weight} - \text{current weight}) \times 100$   
*Adapted from the Sunnybrook Clinical Nutrition Resource Handbook*

<b>Time Frame</b>	<b>Significant Weight Loss (%)</b>	<b>Severe Weight Loss (%)</b>
<b>1 week</b>	1-2	> 2
<b>1 month</b>	5	> 5
<b>3 months</b>	7.5	> 7.5
<b>6 months</b>	10	> 10
<b>Unlimited time</b>	10-20	> 20

**% Usual Body Weight (UBW), with malnutrition interpretations**  
 $\% \text{ UBW} = (\text{current body weight} \div \text{usual body weight}) \times 100$   
*Adapted from the Sunnybrook Clinical Nutrition Resource Handbook*

<b>UBW range (%)</b>	<b>Interpretation</b>
85 – 95	May indicate mild malnutrition
75 – 84	May indicate moderate malnutrition
< 74	May indicate severe malnutrition

## Carson's Anthropometric Data: Body Weight

- **Height:** 6'1" (1.85 m)
- **Current weight:** 130 lbs (59 kg)
- **Current BMI:**  $59 \text{ kg} \div 1.85 \text{ m}^2 = 17.2 \text{ kg/m}^2$
  
- **Usual weight:** 155 lbs (70.4 kg)
- **Timeframe of weight loss:** 6 months
- **% weight loss:**  $([70.4 \text{ kg} - 59 \text{ kg}] \div 70.4 \text{ kg}) \times 100 = 16.2\%$
- **% UBW:**  $(59 \text{ kg} \div 70.4 \text{ kg}) \times 100 = 83.8\%$



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=136#h5p-37>

# Physical Assessment

## SGA Guidance

Another important assessment strategy is to physically evaluate your patient. It is important to go into your patient's room to evaluate physical signs and symptoms of malnutrition. The SGA provides guidance on how to complete a physical examination by using a head to toe method for the assessment of muscle wasting, subcutaneous fat, and fluid retention.

**SGA guidance for assessment of Muscle Wasting**

Source: [Canadian Malnutrition Task Force SGA Form \(PDF\)](#)

**\*\* Note: in the elderly, this may reflect aging, not malnutrition.**

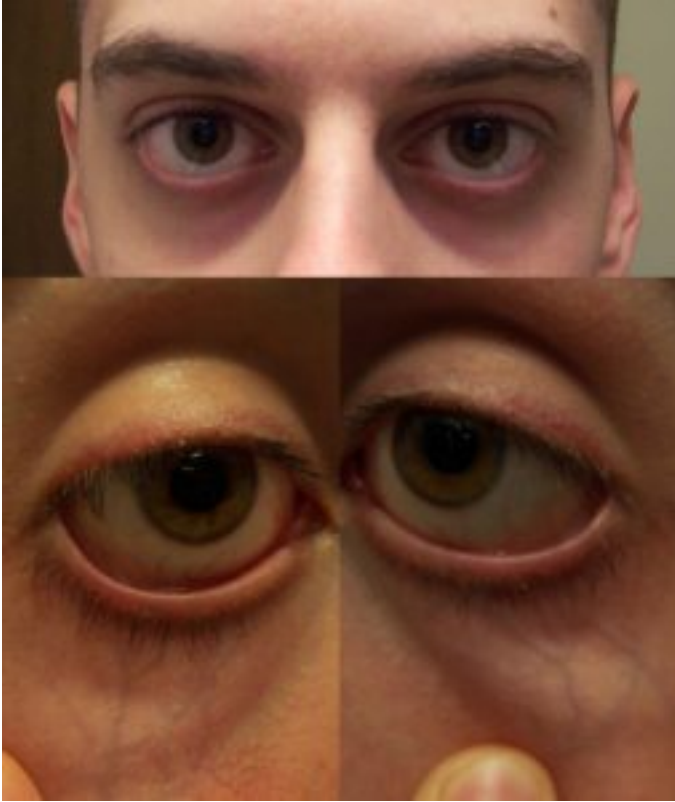
<b>Physical Examination</b>	<b>Normal</b>	<b>Moderate</b>	<b>Severe</b>
<b>Temple</b>	Well-defined muscle	Slight depression	Hollowing, depression
<b>Clavicle</b>	Not visible in males, may be visible but not prominent in females	Some protrusion; may not be all the way along	Protruding/ prominent bone
<b>Shoulder</b>	Rounded	No square look, <b>acromion process</b> may protrude slightly	Square look, bone prominent
<b>Scapula/ribs</b>	Bones not prominent	Mild depression or bone may show slightly	Bone prominent, significant depressions
<b>Quadriceps</b>	Well defined	Depression/ atrophy medially	Prominent knee, severe depression medially
<b>Interosseous muscle between thumb and forefinger (back of hand)**</b>	Muscle protrudes, could be flat in females	Slightly depressed	Flat or depressed area



The interosseous muscle is depressed in a patient with muscle wasting. [Photo by Juniper Publishers](#) is licensed under a [Creative Commons Attribution 4.0 International License](#)

**SGA guidance for assessment of Subcutaneous Fat**  
**Source: Canadian Malnutrition Task Force SGA Form**

<b>Physical Examination</b>	<b>Normal</b>	<b>Moderate</b>	<b>Severe</b>
<b>Under the eyes</b>	Slightly bulging area.	Somewhat hollow look, slightly dark circles.	Hollowed look, depression, dark circles.
<b>Triceps</b>	Large space between fingers.	Some depth to fat tissues, but not ample. Loose fitting skin.	Very little space between fingers or finger touch.
<b>Ribs, lower back, sides of trunk</b>	Chest is full, ribs do not show. Slight to no protrusion of the <b>iliac crest</b> .	Ribs obvious, but indentations are not marked. Iliac crest somewhat prominent.	Indentation between ribs obvious. Iliac crest very prominent.



Hollow, dark circles under the eyes. [Photo by Serdar G., CC0](#), via Wikimedia Commons

**SGA guidance for assessment of Fluid Retention**  
**Source: Canadian Malnutrition Task Force SGA Form**

<b>Physical Examination</b>	<b>Normal</b>	<b>Moderate</b>	<b>Severe</b>
<b>Edema</b>	None	Pitting edema of extremities / pitting to the knees, possible <b>sacral</b> edema if bedridden	Pitting beyond knees, sacral edema if bedridden, may also have generalized edema
<b>Ascites</b>	Absent	Present (may only be present on imaging)	Present (may only be present on imaging)

## Other Physical Signs & Symptoms

There are other physical signs and symptoms of nutritional deficiencies. This table provides a general overview of the sites of the body to consider, the physical examination, and the potential nutritional deficiencies or metabolic status associated with the assessment.

**Physical signs & symptoms of nutritional deficiencies, by site of the body**

Site	Physical Examination	Potential Nutritional/ Metabolic Status
<b>Skin Integrity</b>	<ol style="list-style-type: none"> <li>1. Pallor</li> <li>2. Dry, scaly skin</li> <li>3. Dermatitis</li> </ol>	<ol style="list-style-type: none"> <li>1. Iron, folate, or B12 deficiency</li> <li>2. Vitamin A or <b>EFA</b> deficiency</li> <li>3. EFA, zinc, niacin, or riboflavin deficiency</li> </ol>
<b>Face</b>	Moon face or bilateral temporal wasting	Protein- calorie malnutrition
<b>Mouth</b>	Dry, cracked, red lips	Riboflavin, niacin, B12 deficiency
<b>Abdomen</b>	Rounded, distended	Gas, edema, ascites, obesity
<b>Temperature</b>	Increased temperature	Increased energy and fluid requirements
<b>Respiration</b>	Increased respiratory rate	Altered calorie and protein requirements Energy needs may be increased if weaning from ventilator or decreased if chronically ventilator dependent

Carson's Anthropometric Data: Physical Assessment

- Mild-moderate bilateral temporal wasting, adipose and lean body mass (LBM) tissue loss (triceps,

temporalis, and interosseous)

- Physical signs of mild-moderate muscle wasting (in context of BMI and severe % weight loss values – patient appears underweight)
- Reports fatigue and weakness, with minimal exertion
- Can ambulate, but walks infrequently
- No edema or abdominal distension
- Temperature and respiratory rate normal

Carson's physical assessment data appears to validate the anthropometric data and calculations we previously completed, such as his BMI suggesting he is underweight and his weight change suggesting severe weight loss.

## Nutritional Requirements

### Energy Requirements

Predictive equations are for estimation purposes only. The most accurate data will provide the most accurate estimation, but without indirect calorimetry this is the best we can achieve. As a result, there is a need for frequent re-assessment of energy requirements.

Factors affecting the accuracy of estimated requirements include:

- Acute or chronic respiratory distress syndrome
- Large open wounds or burns
- Malnutrition with altered body composition

- Underweight, obesity, limb amputation, peripheral edema, ascites
- Multiple or neurological trauma
- Multisystem organ failure
- Postoperative organ transplantation
- Sepsis
- Systemic inflammatory response syndrome
- Paralytic or barbituate agents

## Predictive Equations

Here are three commonly used predictive equations. There are other predictive equations you may use, depending on your area of practice. **Accuracy varies by equation and population.** Experience is helpful for an accurate selection and utilization of these predictive equations.

### Abbreviations:

- EER = estimated energy requirements
- REE = resting energy expenditure (kcal)
- A = age (years)
- PA = physical activity
- W = weight (kilograms)
- H = height (centimetres, unless otherwise specified)
- H\* = height (metres)

- Dietary Reference Intakes (DRI)

- EER: age, physical activity, weight, height
- Males:  $EER \text{ (kcal)} = 662 - 9.53A + PA \times (15.91W + 549.6H^*)$
- Females:  $EER \text{ (kcal)} = 354 - 6.91A + PA \times (9.36W + 726H^*)$
- Harris Benedict (HB)
  - REE: weight, height, age
  - Males:  $REE \text{ (kcal)} = 66.5 + 13.75W + 5.0H - 6.78A$
  - Females:  $REE \text{ (kcal)} = 655.1 + 9.56W + 1.85H - 4.68A$
- Mifflin-St.Jeor (MSJ)
  - REE: weight, height, age
  - Males:  $REE \text{ (kcal)} = 9.99W + 6.25H - 4.92A + 5$
  - Females:  $REE \text{ (kcal)} = 9.99W + 6.25H - 4.92A - 161$
- Estimated Calories/kg

## Activity Factors

Most predictive equations evaluate resting energy expenditure (REE), meaning you need to consider physical activity energy expenditure in addition to the original calculation. The activity factor (AF) is applied to the REE value. Activity factors are not to be used with DRI equations.

**Activity Factors (AF) for various activity levels**  
 [\*] indicates activities obtained in healthy, free-living people  
 Adapted from the Sunnybrook Clinical Nutrition Resource Handbook

Activity Level	AF
<b>*Resting (lying or sitting)</b>	<b>1.0 - 1.4</b>
Lying still, sedated or asleep	0.9 - 1.1
Lying still, conscious	1.0 - 1.1
Spinal cord injury, 0-4 weeks post-injury	1.1
Bedrest (moving self around bed)	1.15 - 1.2
Mobilizing occasional on ward	1.15 - 1.4
<b>*Sedentary/ Light Activity (standing for long periods)</b>	<b>1.4 - 1.6</b>
Mobilizing frequently on ward	1.4 - 1.5
Regular, intensive physiotherapy	1.5 - 1.6
<b>*Moderate Activity (continuous movement/slow walking)</b>	<b>1.6 - 1.8</b>

## Stress Factors

Most predictive equations evaluate resting energy expenditure (REE), meaning you may need to consider energy expenditure from stress. The stress factor is applied to the REE value.

**Stress Factors (SF) for various clinical statuses**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

<b>Clinical Status</b>	<b>SF</b>
Cancer	0.8 – 1.5
Elective surgery	1.0 – 1.1
Peritonitis	1.05 – 1.25
Multiple/ long bone fractures	1.1 – 1.3
Fever	1.2 per 1°C > 37°C
Spinal cord injury, 0-4 weeks post-injury	1.2
Sepsis	1.2 – 1.4
Severe infection	1.2 – 1.6
Burns	1.2 – 2.0
Infection with trauma	1.3 – 1.55
Multiple trauma, traumatic brain injury	1.4

## Protein Requirements

This table represents general guidelines for protein requirements according to how hypermetabolic your patient is. Consider your individualized patient to determine the most accurate protein requirement. Experience using these methods is helpful. You can consider calculating requirements using various methods and compare values.

**General protein requirements, by patient's hypermetabolic category**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

Patient Category	Protein (g/kg)
Not hypermetabolic: <ul style="list-style-type: none"> <li>• Adults not severely ill or injured</li> <li>• Adults not at risk of refeeding syndrome</li> <li>• Acute elderly patients</li> </ul>	0.8 – 1.5  (1.0 – 1.5 for acute elderly patients)
Moderately hypermetabolic, including: <ul style="list-style-type: none"> <li>• Post-operative (~14 days)</li> <li>• Repletion</li> <li>• Infection</li> <li>• Temperature &gt; 38°C</li> <li>• Head injury</li> <li>• COPD exacerbation</li> </ul>	1.2 – 1.5
Hypermetabolic, including multi-trauma	1.5 – 2.0

The following table represents a more detailed overview of protein requirements specific to various clinical conditions. This may be more useful for you during practice than the general guidelines, if your patient's clinical status is reflected in this table.

**Detailed protein requirements, by patient's clinical status  
Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

<b>Clinical Status</b>	<b>Protein (g/kg)</b>
Normal (non-stressed, non-depleted)	0.8 – 1.0
Postoperative	1.0 – 1.5
Sepsis	1.5 – 2.0
Multiple trauma	1.3 – 1.7
Traumatic brain injury	1.2 – 2.0
Burns	1.2 – 2.0
Catabolism	1.2 – 2.0
Refeeding syndrome	1.2 – 1.5
Cancer	0.8 – 2.0
Hemodialysis	1.1 – 1.2
CCPD/CAPD	1.2 – 1.3
CRRT	1.5 – 2.0
Acute Renal Failure	1.0 – 1.5
Chronic Kidney Disease	0.8 – 1.0
Mild-Moderate Stress	1.2 – 1.3
Moderate-Severe Stress	1.5 – 2.0
Severe + Wound Healing	1.5 – 2.0
HIV (asymptomatic)	1.0 – 1.4
HIV (symptomatic)	1.5 – 2.0
HIV (CD4 < 200/AIDS defining condition)	2.0 – 2.5

# Fluid Requirements

This table represents general guidelines for calculating fluid requirements. Consider your individual patient prior to determining the best method to use. Experience using these methods is helpful. You can calculate requirements using various methods and compare values.

**General guidelines for fluid requirements**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

Based Upon	Method of Fluid Estimation
Weight	<ul style="list-style-type: none"><li>• 100 mL/kg for 1st 10 kg</li><li>• 50 mL/kg for next 10 kg</li><li>• 20 mL/kg for each kg &gt; 20 kg</li></ul>
Energy	1 mL per kcal
Age and weight	<ul style="list-style-type: none"><li>• 16 - 30 years, active: 40 mL/kg</li><li>• 20 - 55 years: 35 mL/kg</li><li>• 55 - 75 years: 30 mL/kg</li><li>• &gt; 75 years: 25 mL/kg</li></ul>
Fluid balance	Urine output + 500 mL/day

## Carson's Nutritional Requirements

Review Carson's energy, protein, and fluid requirements.

For Carson's energy requirements, we selected the Harris Benedict equation. However, when new to practice, or new to a clinical area, it may be helpful to calculate a patient's energy requirement using more than one equation and comparing the values.

**Harris Benedict equation for Carson:**

$$66.5 + 13.75 (59) + 5.0 (185.4) - 6.78 (50) = 1466 \\ (\text{REE}) \times 1.15 (\text{AF} - \text{mobilizing infrequently}) \times 1.0 \\ (\text{SF} - \text{elective surgery and cancer}) = 1686 \text{ kcal/} \\ \text{day}$$

Regarding activity factors, these are frequently overestimated. An AF of 1.15 is appropriate for a patient who is mobilizing occasionally around the ward. Carson is fatigued, weak, deconditioned, and is likely not getting up and walking around. He may even be a fall risk and require staff supervision, which makes it even less likely that he will ambulate. If he was a "real" patient, you could liaise with the physiotherapist or nurse to assess his mobility and determine his AF.

Regarding his stress factor, it would be appropriate to use 1.0 because of Carson's recent surgery and cancer diagnosis. The plan is for Carson to start radiation therapy and chemotherapy, therefore his SF may increase with the onset of treatment. Carson's SF will need to be re-evaluated over time.

In this case, as Carson is malnourished, it would be

reasonable to select the higher end of his caloric estimation.

**Calories/kg calculation:**  $25\text{-}30 \text{ kcal/kg} \times 59 \text{ kg} = 1475\text{-}1770 \text{ kcal/day}$

**Carson's energy Requirements:**  $\sim 1770 \text{ kcal/day}$   
( $30 \text{ kcal/kg}$ )

For Carson's protein requirements, it is appropriate to use the detailed chart to select a range because he is post-operative and has a cancer diagnosis. The chart suggests a wide range of  $1.0\text{-}1.5 \text{ g/kg/day}$ . Due to the type of cancer and the surgery he had, an appropriate range would be  $1.2\text{-}1.3 \text{ g/kg/day}$  to start. Carson has evidence of malnutrition and muscle wasting, so it is likely that these requirements will need to be reassessed.

**Protein requirements calculation:** range from  $1.0\text{-}1.5 \text{ g/kg}$  (for post-operative and cancer diagnosis) =  $59\text{-}88 \text{ g/day}$

**Carson's protein requirements:**  $71\text{-}77 \text{ g/day}$   
( $1.2\text{-}1.3 \text{ g/kg/day}$ )

**Fluid requirement calculation:** 35 mL/kg (for ages 20-55) × 59kg = 2065 mL/day  
**Carson's fluid requirements:** 2065 mL/day (35 mL/kg)

## Biochemical Data

### Laboratory Values

In the hospital, you will have access to a variety of laboratory values. The table below represents common laboratory values to review for all patients. Depending on your patients diagnosis, you may have to review additional values.

### Common laboratory values

Laboratory Value	Normal Range
WBC	4.00 -11.00 E9/L
Glucose (Random)	4.0 - 7.8 mmol/L
Sodium (Na <sup>+</sup> )	135 - 145 mmol/L
Potassium (K <sup>+</sup> )	3.5 - 5.0 mmol/L
Chloride (Cl <sup>-</sup> )	96 - 106 mmol/L
Phosphorus (PO <sub>4</sub> )	0.8 - 1.35 mmol/L
Calcium (Ca <sup>2+</sup> )	2.1 - 2.1 mmol/L
Magnesium (Mg <sup>2+</sup> )	0.63 - 0.94 mmol/L
Albumin (Alb)	35 - 50 g/L
Blood Urea Nitrogen (BUN)	3.0 - 7.0 mmol/L
Creatinine (Cr)	44 - 80 μmol/L

## Carson's Biochemical Data: Lab Values

Review Carson's lab values in the table below. The "Notes" column indicates which values are outside of target range and explains how to correct calcium and magnesium when albumin values are <35g/L.

**Carson's laboratory values**

[\*] indicates values outside the target range

Laboratory Value	Carson's Value	Notes
<b>Sodium (Na<sup>+</sup>)</b>	138 mmol/L	N/A
<b>Potassium (K<sup>+</sup>)</b>	<b>*3.3 mmol/L</b>	Outside the target range
<b>Chloride (Cl<sup>-</sup>)</b>	96 mmol/L	N/A
<b>Phosphorus (PO<sub>4</sub>)</b>	<b>*0.7 mmol/L</b>	Outside the target range
<b>Calcium (Ca<sup>2+</sup>)</b>	<b>*2.0 mmol/L</b> corrected = 2.28mmol/L	Outside the target range Correct when albumin is <35 g/L Corrected calcium = (normal albumin - abnormal albumin) × 0.02 + Ca <sup>2+</sup> value Calcium calculation for Carson: (40 - 26) × 0.02 + 2.0 = 2.28 (normal)
<b>Magnesium (Mg<sup>2+</sup>)</b>	<b>*0.60 mmol/L</b> corrected = 0.67mmol/L	Outside the target range Correct when albumin is <35 g/L Corrected magnesium = (normal albumin - abnormal albumin) × 0.005 + Mg <sup>2+</sup> value Calcium calculation for Carson: (40 - 26) × 0.005 + 0.6 = 0.67 (normal).

<b>Albumin (Alb)</b>	<b>*26 g/L</b>	Outside the target range Albumin is <35g/L, requiring corrections for calcium and magnesium.
<b>Blood Urea Nitrogen (BUN)</b>	<b>*2.8 mmol/L</b>	Outside the target range
<b>Creatinine (Cr)</b>	60 µmol/L	N/A

## IV Solutions

Here is an overview of common IV solutions used in hospital. It is important to review which IV solution(s) your patient is receiving as it could be providing a patient with energy/ dextrose. Different IV solutions are also chosen in various clinical scenarios. This needs to be considered when you are creating a nutrition care plan.

**Common IV solutions**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

<b>Solution</b>	<b>Kcal/L</b>	<b>Composition/L</b>
<b>Normal Saline (0.9% NaCl)</b>	0	Na - 154 mmol Cl - 154 mmol
<b>½ Normal Saline (0.45% NaCl)</b>	0	Na - 77 mmol Cl - 77 mmol
<b>D5W (5% Dextrose)</b>	170	Dextrose - 50 g
<b>D10W (10% Dextrose)</b>	340	Dextrose - 100 g
<b>5% Dextrose and 0.9% NaCl</b>	170	Dextrose - 50 g Na - 154 mmol Cl - 154 mmol
<b>2/3 and 1/3 (3.3% Dextrose and 0.3% NaCl)</b>	112	Dextrose - 33 g Na - 51 mmol Cl - 51 mmol
<b>Ringer's Lactate</b>	9	Na - 130 mmol K - 4 mmol Ca <sup>2+</sup> - 1.4 mmol Cl - 109 mmol Lactate - 28 mmol

## Carson's Biochemical Data: IV Solution

Carson is currently receiving IV  $\frac{2}{3} + \frac{1}{3}$  @ 75mL/hr = 1800 mL/day (1.8L) for hydration while NPO:

- 1 L of this solution = 112 kcal, 33 g of dextrose
- $112 \text{ kcal} \times 1.8 \text{ L} = 202 \text{ kcal/day}$
- $33 \text{ g} \times 1.8 \text{ L} = 59 \text{ g of dextrose/day}$

Carson is at risk of refeeding syndrome, therefore we need to consider the amount of dextrose he is receiving from his IV solution. We will take this into consideration when calculating his starting rate and advancing his feeds towards goal rate to prevent overfeeding energy and carbohydrates.

This IV solution and rate was ordered while Carson was NPO, it may not be required now that he is starting on enteral feeds. He has no IV medications that require ongoing infusion.

Liaise with the team to:

- Decrease his IV rate with initiation of feeds; or,
- Change the IV solution to 0.9% NaCl; or,
- Saline lock the IV and provide free water flushes via G-tube.

# Dietary Data

Obtaining accurate dietary data can vary based on your patient (e.g. family members present, patient's cognitive ability, flow sheets or calorie counts, etc.), as well as the setting (e.g. inpatient compared to outpatient).

If possible, collect the following information:

- **Diet order(s):** Important for a representation of daily intake while in the hospital (can include enteral nutrition & supplements).
- **Dietary recall:** 24 hr recall (if recent admission or representation of food consumption in hospital), common eating patterns, or short-term and long-term representation of eating patterns or typical foods.
- **Calorie counts:** Depending on the patient, you may order calorie counts to monitor/determine how much/ what they are eating in hospital.

## Carson's Dietary Data

Over the past 6 months, Carson's diet consists of mostly fluids due to progressive dysphagia and loss of appetite.

Over the past 2 weeks (prior to hospital admission), Carson was not eating or drinking much due to feeling

unwell and having no appetite. Estimated caloric intake ~500 kcal per day.

Carson's dietary intake includes:

- Soups, broths, tea
- Applesauce
- Pudding or yogurt
- Soft drinks
- Tomato juice

Based on Carson's dietary data and our previous physical and anthropometric assessments, we conclude that he is malnourished.

## Refeeding Syndrome

Refeeding syndrome is a concern for any patient who has been without consistent or adequate nutrition for a prolonged period. It is a series of metabolic events that occur as a result of reinstatement of nutrition (carbohydrates) to patients who are starved or severely malnourished. Refeeding syndrome is characterized by low potassium, magnesium, and phosphate with/or without fluid retention.

Serious complications can be avoided by:

- Thorough nutritional assessment
- Appropriate identification of patients at risk
- Slow initiation of feeding
- Careful monitoring

The table below outlines complications of refeeding syndrome.

**Complications of refeeding syndrome**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

	<b>Hypophosphatemia</b>	<b>Hypokalemia</b>	<b>Hypomagnesemia</b>
<b>Cardiac</b>	Arrhythmia, CHF, cardiomyopathy, decreased blood pressure	Arrhythmia, cardiac arrest, EKG changes	Arrhythmia, increased heart rate
<b>Neurological</b>	Altered mental status, paralysis, seizures	Weakness, paralysis, lethargy/confusion	Altered LOC, weakness, seizures, tremors
<b>Respiratory</b>	Respiratory failure, ventilator dependence	N/A	N/A
<b>Skeletal</b>	Rhabdomyolysis, weakness	N/A	N/A
<b>Metabolomic</b>	N/A	Metabolic alkalosis	Hypokalemia, hypocalcemia
<b>Gastrointestinal</b>	N/A	Paralytic ileus, constipation	Abdominal pain, diarrhea, constipation, anorexia

An additional refeeding complication is Hyponatremia 2° hyperglycemia, which can result in: heart failure, arrhythmia, respiratory failure, pulmonary edema, renal failure, muscle cramps, fatigue, fluid retention, swelling/edema.

Risk factors for refeeding syndrome include:

- Suboptimal or no nutritional intake for > 5 days
- Postoperative
- Elderly with multiple comorbidities and decreased physiological reserve
- Cancer diagnosis
- Chronically malnourished: anorexia nervosa, chronic alcoholism, marasmus, prolonged fasting or low energy diet, morbid obesity with profound weight loss, malabsorptive syndrome (i.e. IBS, chronic pancreatitis, short bowel syndrome), high electrolyte losses (i.e. diarrhea, high output

fistula, vomiting)

- Uncontrolled diabetes (i.e. electrolyte depletion, diuresis)
- Long term use of antacids
- Long term use of diuretics
- BMI <18.5
- Ongoing unintentional weight loss

## Carson's Risk of Refeeding Syndrome

Based on Carson's clinical history and dietary information, he is at risk for refeeding syndrome.

Factors that increase Carson's risk include:

- Suboptimal nutritional intake for > 5 days
- Ongoing weight loss (16.2% in 6 months)
- Underweight BMI (17.2 kg/m<sup>2</sup>)
- Postoperative
- Cancer diagnosis

PART 1: ASSESS COMPLETE. Please take a moment to pause and think about the assessment data collected. When you are ready, move on to Part 2: Plan.

# Plan



## Team Rounds

Team rounds are an opportunity to collaborate and communicate with the interdisciplinary team. You may update the team about your patient's care plan and gather important information on their diagnosis, prognosis, consults, current status, expected progression, next steps, and disposition planning.



A doctor, nurse, and other medical staff are pictured conducting rounds in a hospital. [Photo by Madailein Abbott](#) is licensed under [Public Domain](#).

## Common PES Statement Terminology

As you interpret the data from the assessment, you can form PES statements or nutrition diagnoses that help identify nutrition concerns that need to be addressed in your plan. If you are not familiar with how to write a PES statement please review this [resource from the Academy of Nutrition and Dietetics](#). Here are some common nutrition problems that patients requiring enteral nutrition may have:

- Inadequate energy intake
- Inadequate protein intake
- Inadequate oral intake
- Inadequate fluid intake
- Increased nutrient needs
- Malnutrition
- Inadequate vitamin/mineral intake
- Swallowing difficulty
- Impaired GI function
- Intake of unsafe food
- Physical inactivity
- Inability or lack of desire to manage self-care

### Carson's PES Statements

Based on our assessment here are some sample PES

statements for Carson. Pause and practice writing other PES statements for Carson!

- Inadequate protein-energy intake related to esophageal cancer and 6-month history of progressive dysphagia as evidenced by dietary recall (low protein and energy intake), loss of appetite and 25 lbs weight loss.
- Inadequate oral intake related to 6-month history of progressive dysphagia as evidenced by loss of appetite, dietary history (consumption of ~500 kcal/day) and 25 lbs weight loss.
- Malnutrition related to a 6-month history of esophageal cancer resulting in progressive dysphagia as evidenced by low serum lab values (potassium, phosphorus, **BUN**), poor oral intake, dietary history (consumption of ~500 kcal/day), physical assessment and 25 lbs weight loss.

## Enteral Nutrition Planning

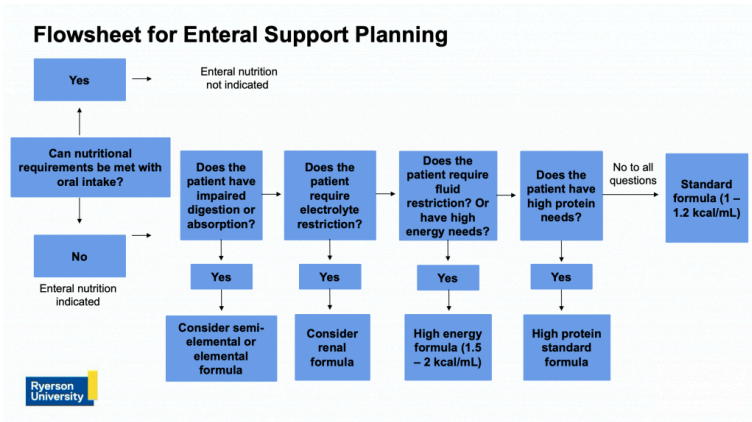
Below are the steps for creating a comprehensive enteral nutrition feeding plan.

1. Summarize and utilize assessment data (energy, protein, fluid requirements).
2. Determine enteral formula (hospital specific formulary) and calculate goal feeding volume/ rate.
3. Conduct refeeding syndrome assessment (to adjust starting rate/ advancement of feeds if appropriate)

4. If no risk of refeeding syndrome determine administration schedule, starting rate & rate of advancement (volume/time).
5. Based on goal feeding rate, **calculate the following**:
  - Energy (kcal/day) & (kcal/kg), protein (g/day) & (g/kg), free water (mL/day) & (mL/kg), fibre (g/day), % DRI of relevant vitamins and minerals.
  - If patient is at risk of refeeding syndrome calculate amount of CHO when initiating feeds (g/day) and at goal rate (g/day).
6. Calculate the required amount of free water flushes for tube **patency** and/or hydration (consider all sources of fluid – IV and medications as well as fluid restrictions).
7. Consider adding a multivitamin and/or other supplements (i.e. Vitamin D).

## Flowsheet

A flowsheet to support enteral planning is presented below. When selecting a plan and formula, it is important to ask yourself the questions listed in the flowsheet. These questions are not comprehensive and you may ask additional questions or encounter other considerations that impact formula selection. However, this is a good starting point.



Flow diagram for enteral support planning. A full text description of the steps are presented below.



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=138#h5p-51>

## Practice Formula Sheet

Refer to the tables below for a practice formula sheet, broken down into three parts: tube feeds, nutrient modules, and meal supplements.

Depending on your hospital's formulary, you may have other options to select from. However, this sheet gives you all the information you need to select a formula and determine the nutritional content for your patients needs. You can use this sheet

to practice additional calculations outside of our case study. If you are using a pre-made sheet or create your own formulary, always check the supplier's website to confirm it is up to date as products change over time.

Practice Formula Sheet: Tube Feeds (Nutrient values)

TUBE FEED	Kcal/ mL	Protein (g/mL)	Fat (g/ mL)	CHO (g/ mL)	%H <sub>2</sub> O	Na (mg)	K (mg/ mmol)	Cl (mg)	Fe (mg)	P (mg)
<b>Isosource 1.2</b>	1.2	0.054	0.04	0.16	80	1.1	1.9/ 0.049	1.3	.014	0.96
<b>Isosource 1.5</b>	1.5	0.068	0.06	0.17	76	1.3	2.4/ 0.06	1.6	0.018	1.2
<b>Isosource 1.0 HP</b>	1	0.064	0.034	0.11	83	0.88	1.6/ 0.041	0.9	0.014	0.8
<b>Novasource renal</b>	2	0.091	0.1	0.19	72	0.95	0.95/ 0.024	0.8	0.018	0.835
<b>Peptamen Intense</b>	1	0.092	0.038	0.076	84	0.68	1.36/ 0.036	1.12	0.012	0.68

Practice Formula Sheet: Nutrient Modules (Nutrient va

NUTRIENT MODULE	Kcal/ mL	Protein (g/mL)	Fat (g/ mL)	CHO (g/ mL)	%H <sub>2</sub> O	Na (mg)	K (mg/ mmol)	Cl (mg)	Fe (mg)	P (mg)	
<b>Beneprotein (per 7g pkg)</b>	25	6	0	0	0	15	35/ 0.9	-	-	-	-

Practice Formula Sheet: Meal Supplements (Nutrient

MEAL SUPPLEMENT	Kcal/ mL	Protein (g/mL)	Fat (g/ mL)	CH (g/ mL)	%H <sub>2</sub> O	Na (mg)	K (mg/ mmol)	Cl (mg)	Fe (mg)	P (mg)
<b>Ensure</b>	1.06	0.04	0.029	0.15	84	0.45	0.68/ 0.017	0.45	0.016	1.6
<b>Ensure Plus</b>	1.5	0.06	0.047	0.22	77	0.45	0.72/ 0.018	0.45	0.016	1.17

## Carson's Enteral Regime

- **Current weight:** 59 kg

- **Carson's nutrition requirements:**
  - Energy: 1770-1800 kcal/day (~30 kcal/kg/day)
  - Protein: 71-77 g/day (1.2-1.3 g/kg/day)
  - Fluid: 2065 mL/day (35 mL/kg/day)
- **Formula selection:** Isosource 1.2 (standard formula)
- **Continuous feeding:** over 20 hours
  - It is common to start enteral nutrition on a patient like Carson with a continuous feeding schedule. He has had a prolonged period of low intake and he is at risk of refeeding syndrome. A continuous feeding schedule will allow us to assess GI and metabolic tolerance.
  - We are feeding over 20 hours because there is a drug-nutrient interaction with levothyroxine, so we need to hold feeds 2 hours before and after administration. Check your institution's policy about holding feeds for drug-nutrient interactions.

Review the requirements and practice calculating Carson's enteral feeding plan using the formulary sheet provided.

**Calculations:**

- Formula amount:  $1800 \text{ kcal} \div 1.2 \text{ kcal/mL} = 1500 \text{ mL/day}$  (at goal volume the DRIs are met)
- Goal rate:  $1500 \text{ mL} \div 20 \text{ hours} = 75 \text{ mL/hr}$
- Provides:
  - Energy:  $1.2 \text{ kcal/mL} \times 1500 \text{ mL/day} = 1800$

kcal/day (30 kcal/kg)

- Protein:  $0.054 \text{ g/mL} \times 1500 \text{ mL} = 81 \text{ g/day}$  (1.3 g/kg)
- Carbohydrate:  $0.16 \text{ g/mL} \times 1500 \text{ mL} = 240 \text{ g/day}$
- Fat:  $0.04 \text{ g/mL} \times 1500 \text{ mL} = 60 \text{ g/day}$
- Free water: 80% of 1500 mL = 1200 mL/day
  - For this amount of formula, there is 1200 mL of free water, which does not meet his estimated requirements for fluid. This is important to keep in mind when calculating water flushes and evaluating other sources of fluid.

## Carson's Enteral Regime: Water Flushes

Prior to calculating Carson's water flushes, liaise with his MD/**NP** to change his IVF to 0.9% NS and decrease his rate to 10 mL/hr. Carson will be receiving ~1200 mL free water from his enteral feeds (at goal rate) and will have a continuous source of CHO (does not require  $\frac{2}{3} + \frac{1}{3}$ ). Patients typically receive 10-25 mL/hr TKVO (to keep vein open).

He is also receiving ~300mL of water for his medication administration. This is information you obtained from his nurse.

Calculate water flushes required for a **total fluid intake (TFI)** of ~2065 mL/day (35 mL/kg)

- **Current sources:**
  - IV 0.9% NS @ 10 mL/hr = 240 mL/day.
  - ~1200 mL free water from his enteral feeds (at goal rate)
  - ~300 mL from medication administration
- **Current total fluid delivery:** IV (240 mL) + medications (300 mL) + feeds (1200 mL) = 1740 mL/day (29 mL/kg)
- **Fluid deficit** = 2065 mL - 1740 mL = 325 mL/day needed via flushes
  - $325 \text{ mL} \div 50 \text{ mL flushes (for tube patency)} = \sim 6 \text{ times per day}$
- **TFI to meet needs:** 240 (IV) + 300 (meds) + 1200 (feeds) + 50×6 (water flushes) = 2040 mL/day (35 mL/kg)
- **Order water flushes:** 50 mL via G-Tube q 4 hours

It is common practice to flush the feeding tube for patency every 4-6 hours with a minimum of 25 mL of water. For Carson, we will order 50 mL water flushes q 4 hrs to meet his needs of approximately 35 mL/kg of fluid per day.

# Protocol for Starting Enteral Nutrition

When starting enteral nutrition, the general protocol is to:

- Start continuous feeding at a slow rate to evaluate tolerance (10–40 mL/hr). If tolerated, increase by increments of 10–25 mL every 4–12 hrs to reach goal rate.
- Consider the hang time of formula: maximum 8 hours per carton to prevent bacterial contamination. If the hourly rate is low, pour half the carton into the enteral feeding bag and discard the remainder
- Flush the feeding tube with water (25–50 mL) every 6 hours for tube patency (minimum – may need increased water flushes depending on formula, tube size, or medications ordered).
- Always evaluate refeeding risk and follow the appropriate implementation practices, if warranted

When your patient is at risk of refeeding syndrome, you should:

- Initiate feeding as soon as possible.
- Determine caloric and protein requirements using current weight
- Start nutrition slowly via **continuous infusion**
- **Energy:** no more than 50% of energy requirements in the first 24 hrs, maximum 15–20 kcal/kg (if at severe risk:  $\leq 10$  kcal/kg).
- Consider **all sources** of carbohydrates (dextrose containing IV fluids, oral intake, medications).
- **Carbohydrate:**  $<150$  g/day or  $< 2$  mg/kg/minute.
- **Protein:** start at the goal of requirements up to 1.5 g/kg.
- **Supplementation:** daily multivitamin and 100 mg thiamine  $\times 3$  days.
- **Obtain bloodwork:** replace low electrolyte levels (prior to initiating feeding, 4–6 hours after initiating feeding, and daily

for minimum 5 days).

## Carson's Plan for Starting Enteral Nutrition

Carson is at risk for refeeding syndrome: start conservatively and advance nutrition slowly.

- Liaise with team to replace low electrolytes:  $K^+$  (3.3),  $PO_4$  (0.7) – prior to initiation of enteral feeds and 6 hours after. Ensure electrolytes are ordered daily  $\times$  5 days and monitor for further replacements
- Liaise with team to order: multivitamin (daily) and 100 mg thiamine (for 3 days)
- Starting rate: Isosource 1.2 @ 25 mL/hr  $\times$  20 hrs (holding 2hrs pre & post Levothyroxine administration)
- Starting rate provides: 600 kcal (10 kcal/kg), 27 g protein/day (0.46 g/kg), 78 g CHO/day – these amounts align with guidelines for refeeding syndrome
- Progression: if tolerated  $\times$  24 hrs, increase 10 mL q 12 hrs to goal rate of 75 mL/hr  $\times$  20 hrs

## Carson's Protein Needs

In Carson's case, the amount of protein he is receiving when initiating enteral feeds is low.

Based on the current plan, **Carson will not meet his goal rate until ~day 3 of enteral feeding** (this is if there are no complications/interruptions to progressing towards goal). It may be worthwhile to incorporate additional protein (Beneprotein®) until the goal rate is reached. **Beneprotein is a protein module (1 pkg = 25 kcal & 6 g protein).**

- **Starting protein intake:** 27 g/day from Isosource 1.2 @ 25 mL/hr × 20 hrs/day.
- **Estimated protein requirement:** 1.2 g/kg = 71 g/day (aim for lower end of target range).
- **Protein deficit:** 71 g requirement - 27 g from feeds = 44 g to meet 1.2 g/kg.
- **Calculation:** 44 g ÷ 6 g per pkg = 7 pkgs required (use 6 pkgs for nurse ease). 6 pkgs provides 150 kcal and 36 g of protein.
- **Starting rate:** Carson will receive 750 kcal (13 kcal/kg/day) and 63 g protein (1.1 g/kg/day) from feeds and Beneprotein.
- **Order:** Mix 2 pkgs of Beneprotein with 100 mL of water and administer via G-tube **TID**. Plan to discontinue or decrease Beneprotein when enteral feeds are near or at goal.

## Summary of Carson's Nutrition Care Plan

Review the final summary for Carson's nutrition care plan before commencing the simulation activity below.

**Summary of Carson's nutrition care plan**

<b>Area of Concern</b>	<b>Recommendations</b>
Enteral nutrition via G-tube	<ul style="list-style-type: none"> <li>• Isosource 1.2 @ 25 mL/hr × 20 hrs + mix 2 pkgs of Beneprotein with 100 mL of water TID</li> <li>• If tolerated after 24 hrs, increase feeds 10 mL q 12 hrs to goal rate of 75 mL/hr × 20hrs</li> <li>• 50 mL water flushes q 4 hrs</li> <li>• Discontinue Beneprotein when rate is near goal</li> <li>• Monitor closely for refeeding syndrome and EN complications</li> </ul>
Medications and infusions	<ul style="list-style-type: none"> <li>• Hold feeds for levothyroxine (2 hours before and 2 hours after administration)</li> <li>• IV 0.9% NS @ 10 mL/hr</li> </ul>
Laboratory values	<ul style="list-style-type: none"> <li>• Liaise with team to replace low electrolytes: K<sup>+</sup> (3.3), PO<sub>4</sub> (0.7), prior to initiation of enteral feeds and 6 hours after.</li> <li>• Ensure labs ordered daily × 5 days &amp; low electrolytes replaced as needed</li> </ul>
Supplements	<ul style="list-style-type: none"> <li>• Daily multivitamin</li> <li>• 100 mg thiamine × 3 days</li> </ul>
Diet	<ul style="list-style-type: none"> <li>• NPO as per SLP assessment due to dysphagia</li> </ul>

## Simulation Activity: Carson



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=138#h5p-63>

PART 2: PLAN COMPLETE. Pause to reflect on the nutrition care plan we created for Carson, as well as the simulation activity. When you're ready, move on to Part 3: Implementation.

# Implement



## Interdisciplinary Team

There are many healthcare professionals involved in the interdisciplinary team. Depending on the patient's medical plan and condition, there may be other team members involved. However, the list below represents a usual inpatient team. Their roles are discussed as it pertains to enteral nutrition.

- **Registered Dietitian:** primarily responsible for enteral nutrition, transition to oral diet.
- **Speech Language Pathologist (SLP):** assess safety of oral diet & texture recommendation.
- **Pharmacist (RPh):** drug and nutrient interactions, medication dosing/ indications.
- **Registered Nurse (RN):** implement nutrition care plan, provide clinical information.
- **Physiotherapist (PT):** ambulation, positioning, assist with obtaining weights.
- **Occupational therapist (OT):** cognitive assessment to determine if patient can provide accurate information, modified eating equipment, positioning.
- **Medical Doctor (MD) or Nurse Practitioner (NP):** medical update, enter orders for IVF, labs, imaging, medications, consults.
- **Social Worker (SW):** provide counselling, disposition planning

and identify sources of emotional support for patients and their families.



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=140#h5p-39>

## Liaising With Carson's Team

In Carson's case, you will want to liaise with:

- **The SLP** regarding Carson's dysphagia. Often, the RD will wait for an SLP assessment to determine the safest diet texture before optimizing the patient's diet for nutritional adequacy. If the SLP recommends a patient be NPO, the RD will implement enteral feeding orders.
- **The MD and/or NP** regarding enteral nutrition for Carson. Provide an update on your nutrition care plan including refeeding risk, enteral regime, water flushes, and request the addition of a multivitamin and thiamine as well as daily bloodwork. The MD/NP

may need to enter some or all of your orders depending on your institution's medical directives.

- **The bedside RN**, once you have finalized your nutrition care plan and the orders have been entered. The RN will be implementing Carson's regime.
- Other team members throughout Carson's stay depending on what his needs are. For example:
  - **The SW** for discharge planning/ support/ resources for enteral feeding at home
  - **The PT** for an updated weight
  - **The OT** for modified feeding utensils

## Monitoring Enteral Feeds

During implementation of the enteral feeding plan, consider monitoring:

- **GI tolerance:** nausea, vomiting, bowel movements (odour, colour, frequency, consistency), abdominal cramping/ distension, reflux, fistula/ostomy output.
- **Bloodwork:** electrolytes, renal profile, calcium profile, liver function tests (LFTs), amylase, blood glucose, complete blood count (CBC), lactate, arterial blood gases (if applicable).
- **Weight:** bi-weekly weight measurements are common for assessment of dietary strategies (or more/less frequently as indicated).
- **Daily intake and output:** fluid balance, actual volume of feed received.
- **Medications:** assess drug-nutrient interactions, add

supplements if indicated, adjust insulin if needed.

Reassess based on changes in tolerance or medical condition.

## **Enteral Nutrition Complications**

The tables below outline potential gastrointestinal, metabolic, and mechanical complications associated with enteral nutrition.

**Possible causes and treatment for gastrointestinal complications**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

<b>Gastrointestinal Problem</b>	<b>Possible Causes</b>	<b>Treatment</b>
<b>Nausea / Vomiting</b>	<ul style="list-style-type: none"> <li>• Gastroparesis</li> <li>• Ileus</li> <li>• Medications (sedation, narcotics, pressors)</li> <li>• Hemodynamic instability</li> <li>• Rapid infusion of feeds</li> <li>• Use of a fibre containing formula</li> </ul>	<ul style="list-style-type: none"> <li>• Motility agent</li> <li>• Reduce infusion rate/volume</li> <li>• Post pyloric feeding</li> <li>• Liaise with team re: meds</li> <li>• Low-fat/isotonic feed</li> </ul>
<b>Malabsorption (unexplained weight loss, steatorrhea, diarrhea)</b>	<ul style="list-style-type: none"> <li>• Celiac</li> <li>• Crohn's disease</li> <li>• Diverticular disease</li> <li>• Radiation enteritis</li> <li>• Pancreatic insufficiency</li> <li>• C. difficile</li> </ul>	<ul style="list-style-type: none"> <li>• Test for malabsorption</li> <li>• Trial semi elemental feed first followed by an elemental feed if still not tolerated</li> </ul>
<b>Abdominal Distension</b>	<ul style="list-style-type: none"> <li>• Ileus</li> <li>• Constipation</li> <li>• GI obstruction</li> <li>• Ascites</li> <li>• Initial use of fibre-feed</li> </ul>	<ul style="list-style-type: none"> <li>• Rule out ileus or obstruction</li> <li>• Request additional bowel routine to promote bowel movements</li> <li>• Hold feeds only if necessary</li> <li>• Change to a non-fibre containing formula if distension is not resolving or is causing significant discomfort</li> </ul>

<b>Constipation</b>	<ul style="list-style-type: none"><li>• Inadequate fibre/ water</li><li>• Limited mobility</li><li>• Medications - especially narcotics/ paralytics</li><li>• Insufficient bowel routine ordered/ administered</li></ul>	<ul style="list-style-type: none"><li>• Add/increase bowel routine</li><li>• Adequate hydration</li><li>• Switch to fibre-containing feed</li><li>• Mobilize as tolerated</li><li>• Adjust medications if possible</li></ul>
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**Possible causes and treatment for metabolic complications**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

<b>Metabolic Problem</b>	<b>Possible Causes</b>	<b>Treatment</b>
<b>Hypertonic Dehydration</b>	<ul style="list-style-type: none"> <li>• Excessive fluid loss</li> <li>• Inadequate fluid intake</li> <li>• Concentrated feed in a patient who cannot express thirst</li> </ul>	<ul style="list-style-type: none"> <li>• Additional fluid</li> </ul>
<b>Overhydration</b>	<ul style="list-style-type: none"> <li>• Excess fluid intake</li> <li>• Refeeding syndrome</li> <li>• Renal, hepatic, or cardiac dysfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Fluid restricted feed, if indicated</li> <li>• Diuresis, if indicated</li> <li>• Decrease free water flushes</li> </ul>
<b>Hypokalemia</b>	<ul style="list-style-type: none"> <li>• Refeeding syndrome</li> <li>• Catabolic stress</li> <li>• K-depleting medication</li> <li>• Excess losses (diarrhea, NG tube)</li> <li>• Metabolic alkalosis</li> </ul>	<ul style="list-style-type: none"> <li>• Correct K to prevent refeeding</li> <li>• K replacement/ supplementation</li> </ul>
<b>Hyperkalemia</b>	<ul style="list-style-type: none"> <li>• Metabolic acidosis</li> <li>• Renal failure</li> <li>• K-sparing medication</li> <li>• Excess K intake</li> </ul>	<ul style="list-style-type: none"> <li>• Correct acidosis</li> <li>• Correct K</li> <li>• Adjust medications if possible</li> <li>• K-restricted feed</li> </ul>

<p><b>Hypонатremia</b></p>	<ul style="list-style-type: none"> <li>• Dilution due to increased antidiuretic hormone (ADH)</li> <li>• Renal, hepatic, or cardiac dysfunction</li> <li>• Excess free water administration</li> </ul>	<ul style="list-style-type: none"> <li>• Consider supplementation</li> <li>• Diuresis if indicated</li> <li>• Fluid restricted feed, if indicated</li> <li>• Decrease free water flushes</li> </ul>
<p><b>Hypernatremia</b></p>	<ul style="list-style-type: none"> <li>• Inadequate fluid intake</li> <li>• Increased fluid loss</li> <li>• Increased IV Na intake</li> </ul>	<ul style="list-style-type: none"> <li>• Additional fluid if indicated</li> <li>• Adjust IV solution</li> </ul>
<p><b>Hypophosphatemia</b></p>	<ul style="list-style-type: none"> <li>• Refeeding syndrome</li> <li>• Excess calories</li> <li>• Binding by epinephrine</li> <li>• Meds (i.e. antacids)</li> <li>• Insulin</li> </ul>	<ul style="list-style-type: none"> <li>• Correct Phos to prevent refeeding</li> <li>• Phos replacement/supplementation</li> </ul>
<p><b>Hyperphosphatemia</b></p>	<ul style="list-style-type: none"> <li>• Renal failure</li> </ul>	<ul style="list-style-type: none"> <li>• Phosphate binder</li> <li>• Phos restricted feed</li> </ul>
<p><b>Hyperglycemia</b></p>	<ul style="list-style-type: none"> <li>• Medical issues (diabetes, sepsis, catabolism, trauma, metabolic stress)</li> <li>• Insulin resistance</li> <li>• Refeeding syndrome</li> <li>• Excess carbohydrate (CHO) intake</li> </ul>	<ul style="list-style-type: none"> <li>• Correct blood glucose (BG) as per protocol</li> <li>• Adjust CHO intake</li> </ul>

<b>Hypoglycemia</b>	<ul style="list-style-type: none"><li>• Abruptly stopping feeds when a pt is receiving hypoglycemic agents or insulin</li></ul>	<ul style="list-style-type: none"><li>• Correct BG as per protocol</li><li>• Taper feed gradually</li></ul>
<b>Hypercapnia</b>	<ul style="list-style-type: none"><li>• Overfeeding calories</li><li>• Excess CHO intake in context of respiratory dysfunction</li></ul>	<ul style="list-style-type: none"><li>• Metabolic cart (if applicable or available)</li><li>• Decrease total energy/CHO administered</li></ul>

**Possible causes and treatment for mechanical complications**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

<b>Mechanical Problem</b>	<b>Possible Causes</b>	<b>Treatment</b>
<b>Incorrect tube placement</b>	<ul style="list-style-type: none"> <li>• Placement in lung</li> <li>• Pneumothorax</li> <li>• Tube migration</li> </ul>	<ul style="list-style-type: none"> <li>• Chest x-ray (CXR) or abdominal x-ray (AXR) to confirm tube placement prior to use</li> <li>• Replace/ advance/ adjust tube with desired endpoint</li> </ul>
<b>Tube blockage</b>	<ul style="list-style-type: none"> <li>• Inadequate flushing</li> <li>• Small bore tube</li> <li>• Inadequately crushed/ dissolved medications or poorly dissolved “beads” from medication capsules infused to the feeding tube</li> <li>• Poorly dissolved protein powder</li> </ul>	<ul style="list-style-type: none"> <li>• Routine water flushes</li> <li>• Replace tube</li> <li>• Pancrelipase/NaHCO<sub>3</sub> mixture as per pharmacy</li> <li>• Change to liquid or IV meds if possible</li> <li>• Dissolve protein powder in warm water</li> </ul>
<b>Irritation from tube</b>	<ul style="list-style-type: none"> <li>• Sinusitis from NGT/ NDT/NJT</li> <li>• Leakage or wound infection from G-Tube/J-Tube</li> <li>• Prolonged feeding tube use with skin irritation from tape/ dressings securing it in place</li> </ul>	<ul style="list-style-type: none"> <li>• Tube change</li> <li>• Proper tube/wound care</li> <li>• Changing placement of tape/ dressings if able</li> </ul>
<b>Aspiration</b>	<ul style="list-style-type: none"> <li>• Lower esophageal sphincter always open with temporary tubes (i.e. NGT/OGT)</li> <li>• Supine position</li> <li>• Tube migration over time</li> </ul>	<ul style="list-style-type: none"> <li>• Head of bed (HOB) &gt; 45°</li> <li>• Consider small bowel feeding</li> <li>• Motility agent</li> <li>• Occasional re-imaging of tube placement if suspicions of migration</li> </ul>

## Monitoring for Refeeding Syndrome

Below is important information to know for patients who are at risk of refeeding syndrome. Having awareness of what symptoms to watch for, knowing when symptoms occur, and what to do can allow you to optimize your patient's nutritional status as safely as possible.

- Symptoms of refeeding syndrome most often occur within 1-3 days after initiating feeding, but may occur up to 5 days following initiation of feeding.
- Closely monitor your patient's heart rate and fluid intake/output for changes that happen with initiation of feeding.
- Hypophosphatemia is a classic first sign associated with refeeding syndrome.
- Monitor electrolytes daily (K, PO<sub>4</sub>, Mg) for a minimum of 3 days – if your patient is at high risk of refeeding syndrome or shows signs of refeeding syndrome, monitor electrolytes for up to 1 week. Correct abnormalities concurrently with feeding and prior to advancing feeds.
- Advance feeding as soon as is safely possible to avoid hypocaloric feeding for prolonged period (advancement of 200-300 kcal every 1-3 days recommended).

# Education

## Carson's Education

Carson is asking to speak to the dietitian to understand why he is not receiving meals like his roommate. He complains of being hungry and doesn't remember why he had a tube inserted in his stomach.

The dietitian will need to use simple language to describe the indications for EN and how EN is administered via his G-tube. The dietitian should explain possible side effects and complications, but also be able to reassure Carson with evidence that this is the best treatment plan for him at this time.

1. Think about the possible side effects and complications with EN.
2. List 3 benefits of EN that you could share with Carson.
3. Create a plain-language explanation of EN to share with Carson.

Pause and answer these questions using the information provided to you so far.



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=140#h5p-40>

PART 3: IMPLEMENT COMPLETE. Pause to reflect on the implementation strategies discussed. When you're ready, move on to Part 4: Evaluation.

# Evaluate



## Evaluating the Nutrition Care Plan

After you have implemented your nutrition care plan (NCP), you need to follow-up and evaluate it to ensure that it has been effective in addressing your patient's nutrition concerns. This can help you to decide on appropriate changes to make to the nutrition care plan moving forward. When evaluating your plan in an inpatient setting, you will need to gather updated information from the same key areas of nutrition concern that you identified in your initial assessment. This will include, but is not limited to: enteral feeding delivery/tolerance, daily intake and outputs, laboratory values, medications, disposition, and any changes to the medical care plan.

**Questions to evaluate nutrition care plan effectiveness**

<b>Common Nutrition Issues</b>	<b>Evaluate effectiveness of NCP</b>
Enteral Feeds	<ul style="list-style-type: none"> <li>• Have they reached goal rate?</li> <li>• Have they had any side effects or complications?</li> <li>• Are they meeting their needs with the current plan? Does it need to reassessed?</li> <li>• Are enteral feeds still warranted?</li> </ul>
Daily Input and Output	<ul style="list-style-type: none"> <li>• Fluid balance?</li> <li>• Volume of feeds received?</li> <li>• Bowel movements? Urine output? GI tolerance?</li> </ul>
Malnutrition	<ul style="list-style-type: none"> <li>• Has weight changed?</li> <li>• Has energy/lethargy improved?</li> <li>• Changes in appetite?</li> </ul>
Abnormal Electrolytes	<ul style="list-style-type: none"> <li>• Are laboratory values being checked on an appropriate schedule &amp; replaced in a timely manner?</li> <li>• Appropriate changes in diet/enteral feeds?</li> </ul>
Medical Care Plan	<ul style="list-style-type: none"> <li>• Are there any changes to the medical care plan?</li> <li>• Changes in medications that impact the nutrition care plan?</li> <li>• Any updated laboratory work, procedures, treatments, or assessments (SLP, PT)?</li> <li>• Disposition planning? Does this impact your nutrition care plan?</li> </ul>

## Evaluating Carson's Nutrition Care Plan

**Possible outcomes of recommended changes**

<b>Common Nutrition Issues</b>	<b>Evaluate effectiveness of NCP</b>	<b>Outcome</b>
Enteral Feeds	Has reached goal rate. Only complication is diarrhea today (3rd day of enteral feeds).	Evaluate feeds, fluids, medications and bowel routine. What is likely causing his diarrhea?
Daily Input and Output	Experiencing loose stools.	<ul style="list-style-type: none"> <li>• Have changes been made to his medications</li> <li>• Side effect of electrolyte replacements</li> <li>• Infectious</li> <li>• Possible side effect of cancer treatment</li> <li>• Consider decreasing stool softeners</li> <li>• Consider adding fibre or probiotics</li> </ul>
Malnutrition	Only three days since initiation. No need for evaluation at this time.	N/A
Abnormal Electrolytes	Electrolytes have been normal over the past three days. No evidence of refeeding syndrome.	Continue to monitor (up to 7 days). Liaise with team regarding replacements, if necessary (in light of recent diarrhea – risk of greater losses).

Medical Care Plan	No changes to medical care plan. Will start chemotherapy/radiation therapy. Prepare for discharge home once stable on enteral feeds.	Consider progression to bolus feeding.
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## Bolus Feedings Prior to Discharge

Consider transitioning patients to a bolus feeding schedule in preparation for discharge home. Bolus feeding has many benefits for patients who are no longer in a hospital setting, including:

- Hunger/satiety (preparation for eventual transition to oral diet)
- Liberalization from enteral feeding equipment
- Ease of feeding out of the home
- Improved quality of life (QOL)
- Better sleep (due to flexibility in sleep positioning, no equipment noise)
- Ease of participation in therapy/treatments/appointments
- Better glycemic control
- Metabolic optimization

When patients are tolerating their continuous enteral regime at goal volume with no GI/metabolic concerns and it is deemed appropriate/safe/feasible, you can change their feeding schedule to an intermittent or bolus feeding regime.

## Discharge Planning for Carson

In Carson's case, he will be receiving long-term enteral feeds at home with low likelihood of resuming an oral diet while undergoing cancer treatment. He will benefit from a bolus feeding schedule for increased comfort, improved QOL & to make nutrition optimization feasible with his daily cancer treatment schedule.

Consider finances and coverage of enteral supplies and formulas when choosing an enteral regime for patients being discharged home. Also consider what supports patients may require to administer their enteral feeds if they are not able to be independent with the task.

## Progression to Bolus Feeding

Consider the following if you are planning a progression to bolus feeding:

- **Is it appropriate/safe/feasible?**
- **Quality of life:** discuss bolus feeding schedule (number of cans needed, volume of flushes, administration times, flexibility) with patients and families to assess compatibility with their activities of daily living (i.e. do not schedule 5 AM feeds for a patient who does not wake before 9 AM). Consider sleeping

schedules (including naps), medication schedules (especially of time sensitive drugs or those with drug-nutrient interaction), mealtimes/social aspect of feeding, work schedules, therapy/treatment/appointment schedules and family members schedules (if they will be assisting the patient with enteral administration).

- **Tolerance:** some patients can tolerate high volumes of enteral feeds over short periods of time, others cannot (i.e. 1 carton over 15 minutes vs. 1 carton over 1 hour). This is based on the individual; it is important to try the proposed schedule before going home and things can be further adjusted/optimized in the community.
- **Advice and Guidance:** some patients require strict schedules (i.e. exact times, amounts, procedures) whereas others desire more general guidelines (i.e. you require 5 cans of formula daily with an additional 1000 mL free water and the patient/family member(s) can choose how/when to administer it, as long as the recommended total volume is received over 24 hours).
- **Follow-up and progression:** It is also possible to use combination regimes (i.e. bolus feed 3 times throughout the day and provide additional continuous feeds overnight). It is important to ensure that patients who are being discharged home on enteral feeds have RD follow up post-discharge to adjust enteral regimes if needed.

## Carson's Plan for Progression to Bolus Feeding

Carson's current enteral feeding regime is Isosource 1.2 @ 75 mL/hr × 20 hours for a total of 1500 mL enteral formula. 1 carton of Isosource 1.2 is 250 mL. Therefore, Carson would need 6 cartons/day to meet his needs. This will provide 1800 kcal/day (31 kcal/kg), 81 g protein/day (1.4 g/kg), and 1215 mL free water. Therefore, Carson will require 550 mL of water flushes per day through his G-tube to meet his hydration requirement.

- Current Enteral Regime: Isosource 1.2 @ 75 mL/hr × 20 hours = 1500 mL enteral volume.
- Bolus feeds: 1 carton Isosource 1.2 = 250 mL; 1500 mL/250 mL = 6 cartons/day.
- 6 cartons/day = 1500 mL = 1800 kcal/day (31 kcal/kg), 81 g protein/day (1.4 g/kg), 1215 mL free water
- Water flushes: 2065 mL (requirement) – 300 mL (medications) – 1215 mL (free water) = 550 mL

## General Plan

Here is a general plan for Carson to transition to bolus feeding while he is in hospital. To be conservative, it is important to estimate that a longer hang time via gravity

drip of 1 hour per carton would be required for tolerance. This can be adjusted after assessing for tolerance.

- **Proposed Schedule:** 2 cartons (breakfast), 1 carton (lunch), 2 cartons (dinner), 1 carton (evening snack)
- **Implementation:**
  - 2 cartons (500 mL) Isosource 1.2 via gravity drip over 2 hrs at 0600 & 1800 hrs
  - 1 carton (250 mL) Isosource 1.2 via gravity drip over 1 hr at 1200 & 2200 hrs
  - Flush G-tube with 60 mL water pre and post feeds (480 mL)
  - **HOB** >45 degrees while feeding
- **Considerations:**
  - This regime does not avoid drug-nutrient interaction with levothyroxine at 0800 hrs; consider changing the administration time of levothyroxine (for example to 1000 hrs).
  - This bolus feeding plan works in the hospital, but Carson will be receiving chemotherapy and radiation therapy from 1200 h to 1430 h daily on discharge. You will need to adjust the proposed regime (i.e. more concentrated formula to decrease volume & changing feeding times) so he can meet his treatment goals.

## Adjusted Plan

Here is an example of how you may change the feeding

plan to meet Carson's daily needs/ treatment plan. This new plan would likely work much better for Carson and still meets his estimated requirements. The updated plan should be implemented in hospital to make sure Carson can tolerate it before being discharged home.

- **Isosource 1.5 × 5 cartons/day** (more concentrated formula = less enteral volume and number of cartons) to provide:
  - 1875 kcal/day (32 kcal/kg)
  - 85 g protein/day (1.4 g/kg)
  - 950 mL free water
- **Flushes:** 135 mL pre & post feeds × 6 (810 mL) + 300 mL meds + 950 mL free water = 2060 mL/day (35 mL/kg)
- **Administration:**
  - Levothyroxine at 0600 hrs
  - 2 cartons (500 mL) via gravity drip over 2 hrs + 135 mL water pre/post feeds at 0800 – 1000 hrs
  - Chemotherapy/radiation therapy: 1200 -1430 hrs
  - 1 carton (250 mL) via gravity drip over 1 hr + 135 mL water pre/post feeds at 1500 – 1600 hrs
  - 2 cartons (500 mL) via gravity drip over 2 hrs + 135 mL water pre/post at 2000 – 2200 hrs

# The Nutrition Care Process Model

As you use the Nutrition Care Process Model and the learning from this case study as a guide throughout your patient care in practicum, please keep in mind that the process is dynamic, and not step-by-step as all cases are different. You are encouraged to complete the recommended readings for this module and continue to expand your learning in this clinical area of practice.

PART 4: EVALUATE COMPLETE. Pause to reflect on the evaluation strategies discussed, and review the readings and resources in the following section for your information.

You've now completed the Enteral Nutrition module. Please consider providing feedback through the embedded form in the next section.

## Acknowledgements

Emily Opperman, MSc, RD

Michaela Kucab, MHSc, RD

# Feedback Form



*One or more interactive elements has been excluded  
from this version of the text. You can view them online*

here: [https://pressbooks.library.torontomu.ca/  
dietmods/?p=2248](https://pressbooks.library.torontomu.ca/dietmods/?p=2248)

# Reading List

The following is a list of readings and resources to help supplement your learning in this module topic.

## Readings

- Doley J. [Nutrition management of pressure ulcers](#). Nutr Clin Pract. 2010 Feb;25(1):50-60. doi: 10.1177/0884533609359294. PMID: 20130157.
- Heyland DK, Weijs PJ, Coss-Bu JA, Taylor B, Kristof AS, O'Keefe GE, Martindale RG. [Protein Delivery in the Intensive Care Unit: Optimal or Suboptimal?](#) Nutr Clin Pract. 2017 Apr;32(1\_suppl):58S-71S. doi: 10.1177/0884533617691245. Epub 2017 Mar 1. PMID: 28388372.
- [ESPEN Guidelines](#) on adult enteral nutrition:
  - [Introductory to the ESPEN Guidelines on Enteral Nutrition: Terminology, Definitions and General Topics \(PDF\)](#)
  - [Adult Renal Failure \(PDF\)](#)
  - [Intensive Care \(PDF\)](#)

## Additional Resources

- [Complete IDDSI Framework and Detailed Level Definitions](#)
- Nestle Health Science Canada – [Nutrition & Tube Feeding Formulas \(PDF\)](#)

# PARENTERAL NUTRITION

Welcome to the Parenteral Nutrition section! Throughout this section, an inpatient case study will be used to enhance your learning and comprehension of parenteral nutrition. You will learn what information to gather for your assessment, how to interpret that data to form a nutrition care plan, how to implement your patient's care plan, and what to look for when following-up and evaluating your plan. As you progress through the content, please keep in mind that the nutrition care process model used here is dynamic and not a linear, step-by-step process. The case study used here is an example, and not all cases will follow the same path.



*TPN equipment in a critical care unit.*

# Learning Outcomes

By the end of the section you will be able to:

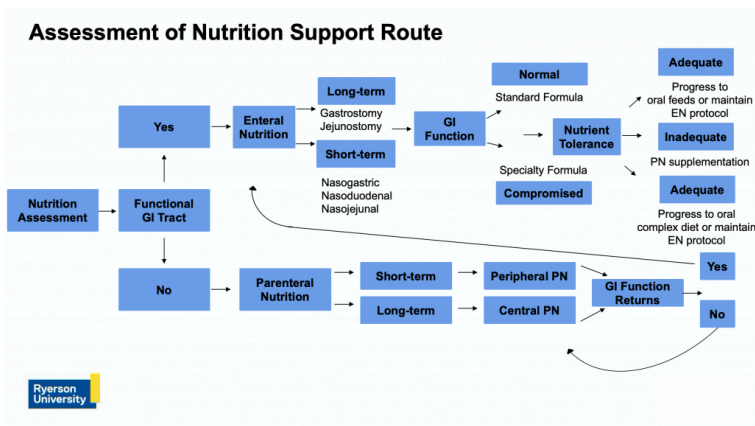
1. Identify indications, contradictions, and routes of support to determine the requirement for parenteral nutrition.
2. Identify the routes, sites of delivery, and delivery methods of parenteral nutrition.
3. Identify how to gather clinical, anthropometric, biochemical, and dietary data necessary to complete a parenteral nutrition assessment.
4. Determine a patient's energy, protein, and fluid needs using data from the initial assessment.
5. Interpret biochemical values, including sodium, potassium, phosphorous, calcium, magnesium, albumin, BUN/urea, and creatinine.
6. Identify the role of a total parenteral nutrition (TPN) team or the interdisciplinary team.
7. Choose an appropriate parenteral nutrition formulation and plan for a patient.
8. Identify a patient at risk of refeeding syndrome and implement procedures to prevent it.
9. Identify the complications of parenteral nutrition and understand the appropriate management procedures.
10. Understand the key factors in appropriately monitoring the parenteral nutrition care plan.
11. Evaluate the nutrition care plan using assessment data relevant to the patient's concerns, including malnutrition, symptom management, parenteral nutrition changes, medications, supplements, and the medical plan.

# Background

## Nutrition Support Routes

Nutrition support is the provision of enteral (EN) or parenteral nutrition (PN) to treat or prevent malnutrition. Nutrition support may be used to supplement oral intake. If the individual cannot eat, it can provide all of that individual's nutritional requirements.

A basic flow diagram for assessment of nutrition support is presented below. This flow diagram can be impacted by a variety of variables but is a good representation of how to assess for enteral or parenteral nutrition. In consideration of more complex patients, you should use this diagram as a starting point for an assessment, not a comprehensive tool for decision making.



Flow diagram of how to assess nutrition support route. A full text description of the steps are presented below .



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=373#h5p-50>

## Parenteral Nutrition

**Parenteral Nutrition (PN)** refers to the infusion of an intravenous nutrition formula into the bloodstream as “parenteral” means “outside” or “alongside” the GI tract. **Total Parenteral Nutrition (TPN)** means that the infusion is an individual’s sole source of nutrition, meeting 100% of their estimated nutrition requirements.

Parenteral nutrition should be considered only when it is not possible to meet an individual’s nutritional requirements by the enteral or oral route. In such cases it may be necessary to bypass the gut and deliver nutrients directly into the bloodstream.

Sometimes parenteral nutrition may also be needed to supplement inadequate oral or enteral intake. This may occur where there is malabsorption (such as in short bowel syndrome or high output fistulas), or poor gut function (such as in intractable vomiting).

### **Benefits of PN include:**

- Include provision of macronutrients, micronutrients and electrolytes
- Maintain weight and lean body mass
- Normalize electrolytes
- Reduce morbidity and mortality
- Improve clinical outcomes and quality of life

**Risks of PN include:**

- Infection,
- Altered liver function, hepatic steatosis, subsequent liver failure
- Line complications (pneumothorax, air embolus, subclavian artery injury, thrombophlebitis)
- Metabolic complications (hyperglycemia, hypertriglyceridemia, vitamin/mineral imbalances, electrolyte imbalances)

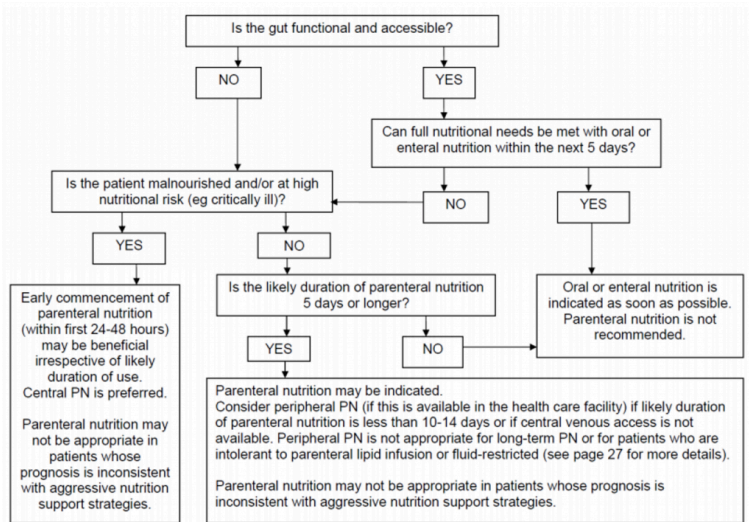
**PN differs from EN in the following ways:**

- Nutrients are provided via vein, bypassing the liver and gut
- There is a greater risk of complications (contamination, more invasive)
- Tolerance is greater
- There is less choice for formula (unless you have access to a compounder)
- Is it more expensive
- It requires continuous administration
- There is a need for daily revision
- There are more psychological effects

## Nutritional Planning for PN

### Making Decisions

A basic flow diagram for parenteral nutrition planning is presented below. It can be used as a general assessment regarding considerations; however it can be affected by a variety of factors. This is where clinical judgment and expertise is required. Parenteral nutrition is often discussed in detail with the interdisciplinary team.



Flow diagram for parenteral nutrition support planning. A full text description of the steps are presented below.  
 Figure. 2.3 Flowsheet for Nutrition Support Planning, From: Dietitians Association of Australia (2018), Parenteral nutrition manual for adults in health care facilities, Nutrition Support Interest Group, Retrieved Feb 25, 2022: <https://dietitiansaustralia.org.au/wp-content/uploads/2018/06/Parenteral-nutrition-manual-june-2018-website.pdf> This figure is being used under fair dealing for the purpose of education.



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=373#h5p-52>

# Assessing the Patient

When creating a parenteral nutrition plan, it is important to follow the general steps listed below.

1. **Determine requirements:** energy, protein, and fluid.
2. **Check for risk of refeeding syndrome**
3. **Determine route of PN:** peripheral vs. central.
4. **Determine appropriate PN formula** (amino acid/dextrose) to meet protein requirements: Calculate goal volume and rate. Dextrose (1 g = 3.4 kcal), Protein (1 g = 4.0 kcal).
5. **Provide remaining energy from lipid:** Calculate goal volume and rate (1 g = 10.0 kcal for 20% lipid emulsions).
6. **Check macronutrient tolerance:** dextrose (< 4-5 mg/kg/min), lipid (< 1 g/kg/day or < 30% of daily kcals), and protein (as per estimated requirements).
7. **Determine electrolyte requirements:** determined based on labs/ requirements.
8. **Consider other additions:**
  - Trace elements: Site specific
  - Multivitamin: Site specific
  - Vitamin K: 2-4 mg per week if PN > 1 week
  - Iron: Not routinely added, not recommended during acute illness or sepsis, may be needed for long-term/home PN patients
  - Ranitidine: Dose as per MD/Pharmacist (RPh), reduces acid secretion
  - Zinc: Daily requirement of 2.5-5.0 mg/day, additional supplementation may be required with high volume stool or ostomy output
  - Additional additives: Discuss with MD/RPh

Note that electrolyte requirements and other additives are very site specific. They also vary tremendously based on if the patient is

critically ill, acutely ill or medically stable and if PN is expected to be short or long term. You should seek further readings or training regarding this.

## Indications & Contraindications

Here is an overview of common **indications** for parenteral nutrition:

- Non-functioning GI tract or conditions precluding the use of the GI tract
- Pre-operative support of patients with moderate to severe malnutrition
- Severe acute exacerbations of Crohn's disease or ulcerative colitis
- High output or proximal GI fistula
- Short bowel syndrome (< 100 cm)
- Severe acute necrotizing pancreatitis
- Complete bowel obstruction
- Prolonged paralytic ileus
- Mesenteric ischemia
- Anticipated requirement for > 7 days

In some cases, at the discretion of the medical team, a patient may receive PN for a reason not listed here. Review the list and look up any of the conditions that you are not familiar with.

Here is a list of the most common **contraindications** for patients who are being assessed to receive parenteral nutrition:

- Functioning GI tract
- Well-nourished and inadequate EN/oral diet for < 5-7 days
- Unstable hemodynamics
- Aggressive intervention not warranted/desired

Depending on your patient, the initiation of PN may be delayed if one of the above conditions is met. If the patient's clinical course changes they may be appropriate to receive PN later in their admission. For example, an ICU patient becomes hemodynamically stable on day 3 and is appropriate to start PN.

## Routes of Administration

Parenteral nutrition can be administered via peripheral or central line.

### Peripheral PN

The access point for **peripheral PN** is via peripheral veins in the extremities (hands or feet).

Peripheral PN is used less commonly, as most hospitals prefer central access or patients do not meet the criteria to start PN. It is a short term solution with patients receiving peripheral PN for 10-14 days maximum with line changes q72hrs for line patency.

Peripheral PN is most useful:

- As supplemental PN
- As bridge therapy during transition periods (suboptimal oral intake/EN)
- In clinical circumstances where central IV access is not warranted
- While waiting for central IV access to be gained

The safe upper limit for osmolality is <900 mOsm/L. Higher volumes are needed to keep osmolality low and meet nutrition requirements.

There is an increased risk of phlebitis with peripheral PN and patients must have normal renal and cardiac function as well as normal lipid metabolism.

## Central PN

The access point for **central PN** is via large vein (i.e. subclavian or vena cava).

Unlike peripheral PN, central PN can be used for any length of time and solutions can be higher osmolality (>1800 mOsm/L) due to high rate of blood flow, which dilutes the hypertonic solution.

Central PN can provide provision of full nutrient requirements, partial/ supplemental nutrient requirements and fluid restricted solutions.

PN can be administered to patients with poor renal and/or cardiac function or altered lipid metabolism via a central line.

## Access Sites

Parenteral nutrition is given into an intravenous access device, a fine silicon or polyurethane tube that is inserted into a vein.

Some intravenous lines contain multiple lumens – tiny separate tubes within the line – enabling several different solutions (including incompatible solutions) to be delivered at the same time.

Parenteral nutrition must be given into a lumen that is dedicated for that purpose. This means the lumen should not be used to give medications or anything other than nutrition. With a 2 in 1 solution, the amino acid/dextrose solution may need to be “Y connected” with the lipids to be infused into one lumen.

In the photo to the right, a two-lumen catheter is inserted on the patient’s left side. Scars at the base of the neck indicate the insertion point into the left jugular vein. The line runs under the skin over the collarbone to a point about seven centimeters below, where it emerges from the chest and splits into the two lumens. Each lumen has a clamp for closing off the line and each terminates with a threaded end for drawing blood for analysis, and attaching lines to infusion pumps, and apheresis and dialysis machines.



A two-lumen catheter

Source: [General Ludd, CC BY-SA 3.0](#),  
via Wikimedia Commons

## Peripheral Venous Access

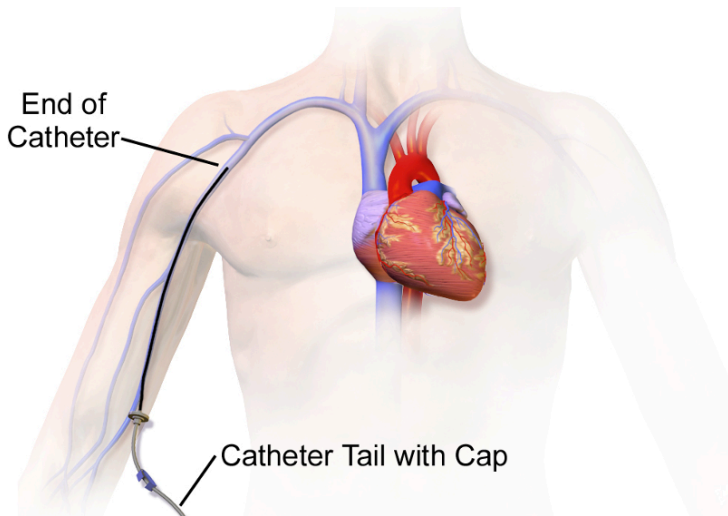
Peripheral lines can be helpful in starting a patient on PN while they are waiting for central access. Peripheral lines are those that have their delivery tip outside the vena cava; the tip may lie in the subclavian or axillary veins in the upper arm or be a standard peripheral cannula in the basilic or cephalic veins of the lower arm. Solutions that can be used peripherally must be limited to < 900 mOsm/kg to minimize blood vessel damage. This means that peripheral parenteral nutrition solutions are usually a larger volume, more dilute solution, with a higher proportion of fat.

Peripheral parenteral nutrition is usually **not recommended** for patients who:

- are fluid-restricted
- have high protein requirements
- are intolerant to IV lipid infusion
- have high serum triglyceride levels

**Advantages and disadvantages of peripheral lines**  
Adapted from Dietitians Association of Australia: [Parenteral Nutrition Manual for Adults in Health Care Facilities \(PDF\)](#).

Type of Line	Advantages	Disadvantages
Peripheral line	<ul style="list-style-type: none"><li>◦ Quick and easy to insert</li><li>◦ Inexpensive</li><li>◦ Very low infection risk</li></ul>	<ul style="list-style-type: none"><li>◦ Usually requires rotation every 3 days due to vein inflammation</li><li>◦ Peripheral delivery limits the solution that can be used</li></ul>



*Peripheral line*

Source: [Blausen Medical Communications, Inc., CC BY-SA 4.0](#), via Wikimedia Commons (cropped from original)

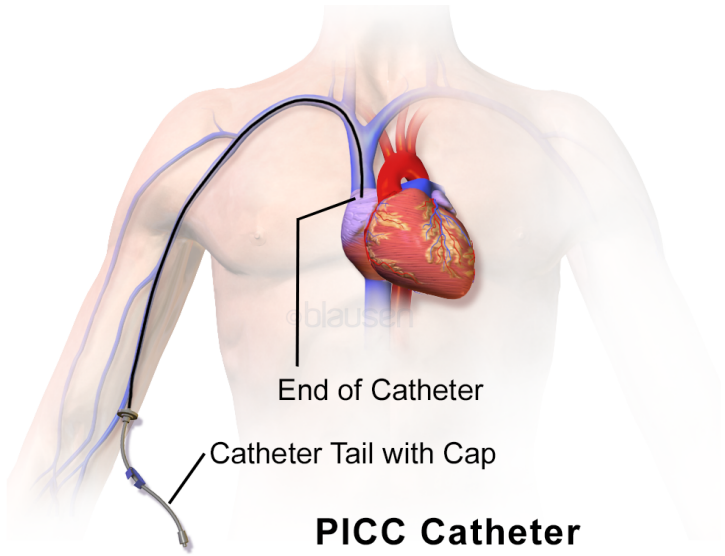
## Central Venous Access

All central venous access devices, by definition, have their delivery tip in the vena cava or right atrium. Different lines/devices will be inserted into different sites on the body, they vary in how long they can be used for, and how complicated the insertion/ removal methods are.

It is important to understand where these lines are inserted, the advantages and disadvantages to each, and to be able to identify what type of line it is when looking at a patient. A comparison and visual representation of common central venous access devices are depicted below.

**Advantages and disadvantages of common central venous access devices**  
 Adapted from Dietitians Association of Australia: [Parenteral Nutrition Manual for Adults in Health Care Facilities \(PDF\)](#).

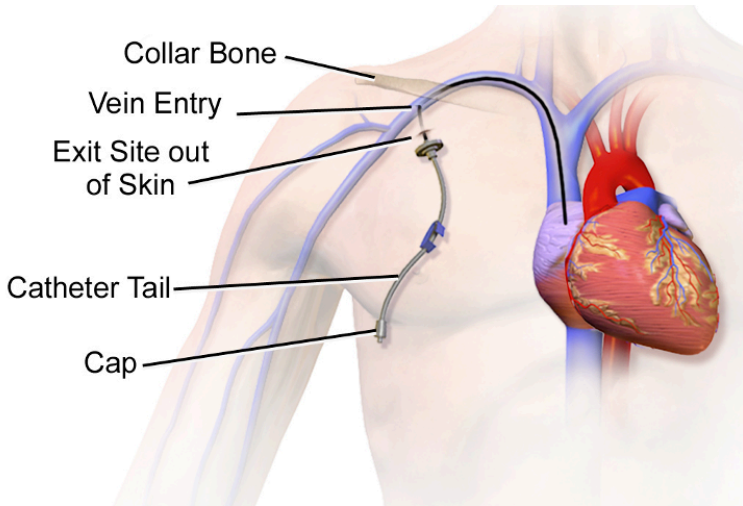
Type of Line	Advantages	Disadvantages
<b>Peripherally-inserted central venous catheter (PICC)</b>	<ul style="list-style-type: none"> <li>• Relatively quick and easy to insert</li> <li>• May be inserted at bedside by a skilled technician</li> <li>• Relatively cheap</li> <li>• Can last up to 12 months</li> <li>• Infection risk lower than for short-term central line</li> </ul>	<ul style="list-style-type: none"> <li>• Difficult for patient to provide self-care of site due to it being placed mid arm, therefore only one hand can be used for care</li> <li>• Single-lumen lines much easier to insert</li> </ul>
<b>Polyurethane short-term central line</b>	<ul style="list-style-type: none"> <li>• Quick and easy to insert and remove</li> <li>• Relatively cheap</li> </ul>	<ul style="list-style-type: none"> <li>• Needs to be changed every 7 days</li> <li>• Higher infection risk</li> <li>• Mostly used in critically ill patients</li> </ul>
<b>Portacath</b>	<ul style="list-style-type: none"> <li>• Very long-lasting</li> <li>• Easiest self-care by patient and least maintenance needed</li> <li>• Hidden under skin</li> <li>• Minimal infection risk</li> </ul>	<ul style="list-style-type: none"> <li>• Complicated insertion and removal</li> <li>• Expensive</li> <li>• Risk of misplacement of needle</li> </ul>



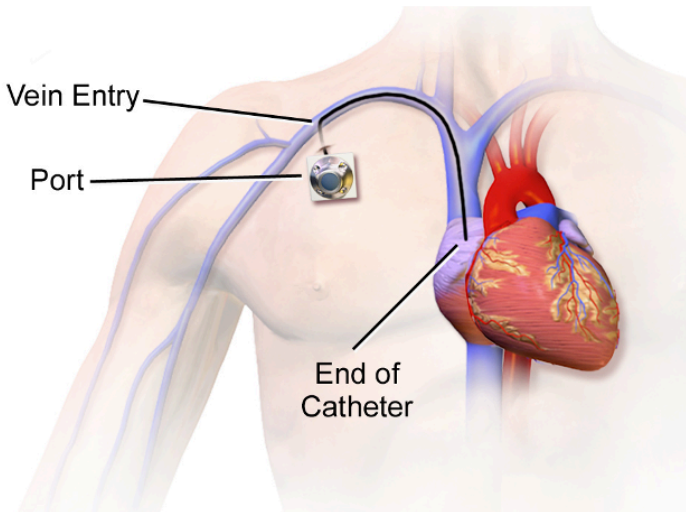
## PICC Catheter

Peripherally-inserted central venous catheter (PICC)

Source: [Blausen Medical Communications, Inc.](#), [CC BY 3.0](#), via Wikimedia Commons



Polyurethane Short-Term Central Line  
Source: [Blausen Medical Communications, Inc., CC BY 3.0](#), via Wikimedia Commons (cropped from original)



Portacath  
Source: [Blausen Medical Communications, Inc., CC BY-SA 4.0](#), via Wikimedia Commons (cropped from original)

# Macronutrients

The table below provides an overview of the macronutrients used in parenteral nutrition, along with a few key considerations for the use of each.

**Explanation of macronutrients in parenteral nutrition**  
 Adapted from Dietitians Association of Australia: [Parenteral Nutrition Manual for Adults in Health Care Facilities \(PDF\)](#).

Macronutrient	Explanation
Protein	<ul style="list-style-type: none"> <li>• Protein in parenteral nutrition is delivered in the form of essential amino acids.</li> <li>• Maintains positive nitrogen balance.</li> <li>• 1 g amino acid = 4.0kcal.</li> <li>• Patients' estimated protein requirements typically vary from 0.8-2.0 g/kg.</li> <li>• Solutions range from 3-15% concentrations.</li> </ul>
Carbohydrate	<ul style="list-style-type: none"> <li>• Dextrose provides the carbohydrate content.</li> <li>• This is the body's main source of energy, and a daily minimum of ~2 g/kg body weight is required to meet the needs of cells (i.e. brain, kidney, erythrocytes) that cannot readily use other fuels.</li> <li>• The maximum preferred rate of glucose oxidation and utilization, is ~4-5 mg/kg/minute. Exceeding this can increase the risk of complications, i.e. hyperglycemia, fatty liver, and respiratory problems.</li> <li>• 1 g dextrose = 3.4 kcal.</li> <li>• Solutions range from 5-70% concentrations.</li> </ul>
Fat	<ul style="list-style-type: none"> <li>• Lipid emulsion is a soluble form of fat that provides essential fatty acids and a concentrated form of energy.</li> <li>• Lipid has a lower osmolality; adding it to a PN formula will lower the total osmolality of the resulting solution; this is important when the solution is to be given peripherally.</li> <li>• Maximum 1.5 g/kg preferred to allow lipoprotein lipase to clear fat from circulation &amp; avoid hypertriglyceridemia.</li> <li>• 1 g = 10 kcal.</li> <li>• 10%, 20% or 30% concentrations.</li> </ul>

## Micronutrients

Vitamins, minerals, and trace elements should be included in parenteral nutrition solutions as depletion of a compromised patient's micronutrient reserves could impair the patient's ability to absorb and utilize nutrients.

Patients who are starting on PN may require different micronutrient additions compared to patients who have been receiving long-term PN. Patients on long-term parenteral nutrition (longer than three to six months) need periodic monitoring of their micronutrient status as body stores may become depleted, even with supplementation, due to ongoing increased demands.

Depending on your hospital, you may be entirely responsible for determining micronutrients. In others, you may have a PN team where other team members (i.e. RPh/ MD) determine additives.

**Examples of micronutrients in parenteral nutrition**  
Adapted from Dietitians Association of Australia: [Parenteral Nutrition Manual for Adults in Health Care Facilities \(PDF\)](#).

Micronutrient	Examples
Water-soluble vitamins	Thiamine, Riboflavin, Niacin, Pantothenic acid, Vitamin B12, Folic acid, Vitamin C, and Biotin
Lipid-soluble vitamins	Vitamin A, Vitamin D, Vitamin E, and Vitamin K
Trace elements	Chromium, Copper, Iodide, Iron, Manganese, Selenium, Zinc, Fluoride

## Electrolytes

Electrolytes must be adjusted daily in a patient who is starting PN to account for losses, disease effects and organ function.

Large deficiencies must be corrected by IV boluses (ordered by the MD/NP) prior to initiating PN or advancing solutions.

Patients may continue to have fluctuating electrolyte levels throughout their admission as their clinical status changes, and may require IV electrolyte replacements even when stable on their goal solution of PN.

Stable patients or individuals who receive long-term PN will have different monitoring protocols/ requirements than those who are starting PN or acutely/critically ill.

Requirements for electrolytes may also be increased if the patient has increased losses, intracellular shifts or increased demand.

#### General guidelines for electrolyte requirements

Electrolyte	Daily requirements	Factors that increase needs
<b>Sodium</b>	1 – 2 mmol/kg	Diarrhea, vomiting, GI losses
<b>Potassium</b>	1 – 2 mmol/kg	Diarrhea, vomiting, medications, refeeding syndrome, GI losses
<b>Calcium</b>	5 – 7.5 mmol/day	High protein intake
<b>Magnesium</b>	4 – 10 mmol/day	Medications, refeeding syndrome, GI losses
<b>Phosphorous</b>	20 – 40 mmol/day	High dextrose loads, refeeding syndrome

## Considerations in Choosing a PN Formulation

Here is a brief overview of additional considerations to take into account when choosing a parenteral nutrition formula.

**Osmolality:** Delivering parenteral nutrition **centrally** (into the vena cava) allows extremely high osmolality solutions to be used, as the

fast blood flow (~2-5 litres/minute) instantly dilutes the solution. A **peripherally** delivered solution should have an osmolality <900 mOsm/kg to avoid irritation to the blood vessels. Lipid has a much lower osmolality than amino acids, glucose or electrolytes, so peripheral solutions are typically high in fat.

**Hang-time:** Interaction between the macronutrients and/or micronutrients can reduce the availability of the nutrients and decrease the stability of the solution. Shelf-life can be prolonged by keeping macronutrients separated (as in a multi-chamber bag) and/or by adding micronutrients into the solution as close as possible to the starting hang time of the infusion.

**Bacterial growth:** Lipid solutions have a lower osmolality and acidity than amino acids or glucose solutions, and therefore provide a better growth medium for bacteria. The hangtime for lipid on its own is shorter than for three-in-one solutions. Most TPN solutions are hung for a maximum of 24hrs.

**Stability:** Loss of stability (i.e. where the lipid ceases to be fully emulsified or where compounds precipitate out of solution) **can make the parenteral nutrition formula unsafe for infusion**. Several factors impact stability including: multi-chamber bags (longer shelf-life) vs. individually-compounded bags (shorter shelf-life), and storage practices (temperature, light, and shelf-life).

**Additives:** Each solution has an upper limit for nutritional additives (i.e. electrolytes or micronutrients) and these additives should be discussed with the pharmacist to ensure safety and stability. Because PN solutions are complex, it is typically not recommended to mix any medications with PN or infuse them through the same lumen. A commonly made exception is insulin, which can be added to the PN solution. If insulin is added to the PN solution, frequent blood glucose monitoring is essential for the entire time that parenteral nutrition is infusing.

Background complete! Feel free to review any resources and move to the next section, “Assess”, when you are ready.

# Assess



## Gathering Data for An Assessment

Before asking the patient questions for your assessment, make sure to introduce yourself and set the agenda for the discussion.

You may review your patient's chart or obtain information from them directly. You will need to gather information on the following:

1. **Clinical Data:** past medical history (PMHx), history of presenting illness (HPI), imaging, investigations, pathology, scheduled procedures, consultations, medical orders (medications, infusions), clinical documentation (fluids in and out, bowel movements, drains and tubes, vitals, and documentation of symptoms), medical plan, disposition plan.
2. **Anthropometric Data:** weight, height, BMI, weight change, % weight change, % usual body weight, physical assessment, subjective global assessment.
3. **Nutritional Requirements:** energy, protein, and fluid
4. **Biochemical Data:** laboratory values (blood, urine, feces, sputum, tissue, wounds, drains etc.).
5. **Dietary Data:** current/recent hospital diet order(s), current, recent, and baseline intake, dietary restrictions, allergies/intolerances, eating behaviours and patterns, calorie counts, supplements, previous nutrition/dietitian interventions.

The components reviewed in each section are common

considerations but you may need to consider other factors depending on your patient.

## Case Study: Meet Poppy



*Your patient, Poppy*

You are a Registered Dietitian in the Intensive Care Unit (ICU). The patient you are assessing is a 76-year-old female named Poppy.

# Assessment Methods

## Head-to-toe

The head-to-toe assessment method is used in the intensive care unit. This method could be used in other areas if you encounter an acutely ill or complex patient. You may encounter this terminology when reviewing chart notes of patients who have been transferred from the ICU; therefore it is important to be familiar with it.

**Head-to-toe assessment method**

System	Considerations
Neurological (CNS)	SAS (sedation agitation scale) score, GCS (Glasgow coma scale), Sedation, Paralytics
Respiratory (Resp)	<b>If vented:</b> type of breathing tube (ETT, type of <b>trach</b> ), vent settings (FiO <sub>2</sub> , PEEP, PS/PC, SaO <sub>2</sub> ), respiratory rate (RR), secretions (type and frequency) <b>If not vented:</b> type of trach, mode of oxygenation (BiPAP, CPAP, Optiflow, face mask, trach mask, nasal prongs (NP)), amount of oxygenation, secretions (type and frequency)
Cardiovascular (CVS)	Intra-aortic balloon pump (IABP) and settings, heart rate (HR), blood pressure (BP), mean arterial pressure (MAP), IV access and solution
Gastrointestinal (GI)	Abdomen soft vs. firm, distended, type of feeding tube, NG output mode (suction/drainage/clamp) + 24 hour output, feeding formula/rate, amount of daily protein supplementation, nausea/vomiting, bowel movements (type and frequency), 24 hour stoma output, labs (lactate, liver function tests (LFT's))
Genitourinary (GU)	Urine output (mL/hr, mL/day), 24hr fluid balance, diuretics, dialysis, labs (urea, creatinine, K, PO <sub>4</sub> , sodium)
Infectious Disease	Temperature (max in 24 hr), microbiology result, antibiotics, labs (white blood count (WBC))
Physical Assessment	Generalized/pitting edema, ascites, wounds, lean body mass wasting, <b>diaphoresis</b>

# Subjective Global Assessment

Another important assessment strategy is to physically evaluate your patient for signs and symptoms of malnutrition.

According to the [Canadian Malnutrition Task Force](#):

Subjective global assessment (SGA) is the gold standard for diagnosing malnutrition. SGA is a simple bedside method used to diagnose malnutrition and identify those who would benefit from nutrition care. The assessment includes taking a history of recent intake, weight change, gastrointestinal symptoms and a clinical evaluation.

The SGA provides guidance on how to complete a physical examination by using a head-to-toe method for the assessment of muscle wasting, subcutaneous fat and fluid retention.

**SGA guidance for assessment of Muscle Wasting**

Source: [Canadian Malnutrition Task Force SGA Form \(PDF\)](#)

[\*\*] Note: in the elderly, this may reflect aging, not malnutrition.

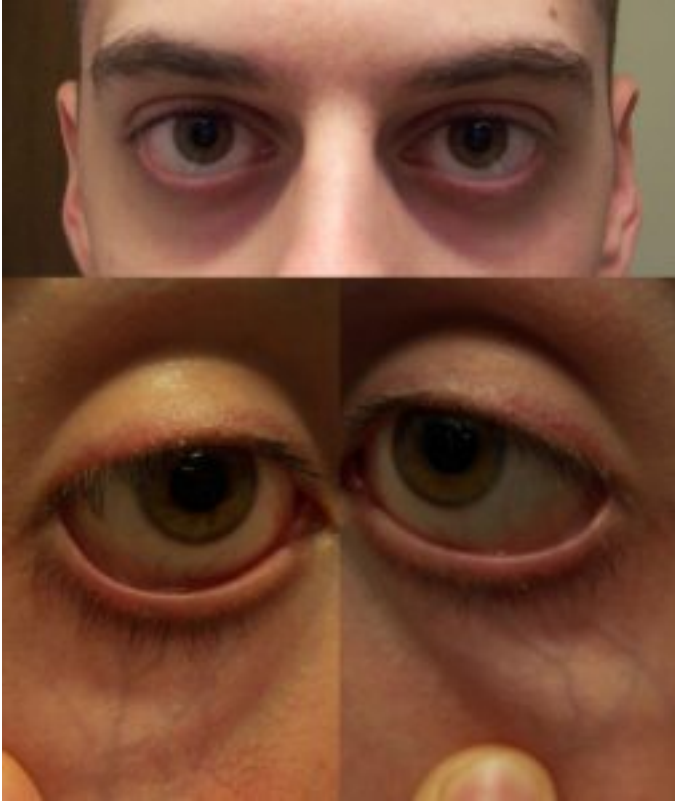
Physical Examination	Normal	Moderate	Severe
<b>Temple</b>	Well-defined muscle	Slight depression	Hollowing, depression
<b>Clavicle</b>	Not visible in males, may be visible but not prominent in females	Some protrusion; may not be all the way along	Protruding/ prominent bone
<b>Shoulder</b>	Rounded	No square look, <b>acromion process</b> may protrude slightly	Square look, bone prominent
<b>Scapula/ribs</b>	Bones not prominent	Mild depression or bone may show slightly	Bone prominent, significant depressions
<b>Quadriceps</b>	Well defined	Depression/ atrophy medially	Prominent knee, severe depression medially
<b>Interosseous muscle between thumb and forefinger (back of hand)**</b>	Muscle protrudes, could be flat in females	Slightly depressed	Flat or depressed area



The interosseous muscle is depressed in a patient with muscle wasting. [Photo by Juniper Publishers](#) is licensed under a [Creative Commons Attribution 4.0 International License](#)

**SGA guidance for assessment of Subcutaneous Fat**  
**Source: Canadian Malnutrition Task Force SGA Form**

<b>Physical Examination</b>	<b>Normal</b>	<b>Moderate</b>	<b>Severe</b>
<b>Under the eyes</b>	Slightly bulging area.	Somewhat hollow look, slightly dark circles.	Hollowed look, depression, dark circles.
<b>Triceps</b>	Large space between fingers.	Some depth to fat tissues, but not ample. Loose fitting skin.	Very little space between fingers or finger touch.
<b>Ribs, lower back, sides of trunk</b>	Chest is full, ribs do not show. Slight to no protrusion of the <b>iliac crest</b> .	Ribs obvious, but indentations are not marked. Iliac crest somewhat prominent.	Indentation between ribs obvious. Iliac crest very prominent.



Hollow, dark circles under the eyes. [Photo by Serdar G., CC0](#), via Wikimedia Commons

**SGA guidance for assessment of Fluid Retention**  
**Source: Canadian Malnutrition Task Force SGA Form**

<b>Physical Examination</b>	<b>Normal</b>	<b>Moderate</b>	<b>Severe</b>
<b>Edema</b>	None	Pitting edema of extremities / pitting to the knees, possible <b>sacral</b> edema if bedridden	Pitting beyond knees, sacral edema if bedridden, may also have generalized edema
<b>Ascites</b>	Absent	Present (may only be present on imaging)	Present (may only be present on imaging)

## Physical Assessment

In addition to the head to toe method and the SGA, it is important to go into your patient's room to evaluate physical signs and symptoms of nutrition deficiencies. It is important to consider evaluating skin integrity, face, mouth, abdomen, temperature and respiration, when possible.

**Physical signs & symptoms of nutritional deficiencies, by site of the body**

Site	Physical Examination	Potential Nutritional/ Metabolic Status
<b>Skin Integrity</b>	<ol style="list-style-type: none"> <li>1. Pallor</li> <li>2. Dry, scaly skin</li> <li>3. Dermatitis</li> </ol>	<ol style="list-style-type: none"> <li>1. Iron, folate, or B12 deficiency</li> <li>2. Vitamin A or <b>EFA</b> deficiency</li> <li>3. EFA, zinc, niacin, or riboflavin deficiency</li> </ol>
<b>Face</b>	Moon face or bilateral temporal wasting	Protein- calorie malnutrition
<b>Mouth</b>	Dry, cracked, red lips	Riboflavin, niacin, B12 deficiency
<b>Abdomen</b>	Rounded, distended	Gas, edema, ascites, obesity
<b>Temperature</b>	Increased temperature	Increased energy and fluid requirements
<b>Respiration</b>	Increased respiratory rate	Altered calorie and protein requirements  Energy needs may be increased if weaning from ventilator or decreased if chronically ventilator dependent

## Clinical Data

Clinical data can include, but is not limited to:

- **Reason for visit:** hospital visit or RD consult.
- **Past medical history** (PMHx): health history to date.
- **History and presenting illness** (HPI): symptoms, surgeries, prognosis, tests (i.e. CT scan, ultrasound).
- **Current medical orders:** IV infusions, medications, consultations.
- **Clinical documentation:** Fluids intake (i.e. oral, IV, TPN/EN)

and output (i.e. urine, vomit, bowel movements, drains (i.e. catheter, chest tube, surgical site drain) and suctioning (i.e. oral secretions, OGT to straight drain), documentation of tubes (i.e. G-tube vs. NGT) and lines (i.e. PICC), vitals.

- **Medical care plan and disposition:** chemotherapy, radiation therapy, scheduled surgery, transfer to different floor, rehab facility, treatment facility, long term care, home.

## Poppy's Clinical Data

Review Poppy's clinical data. Take note of components that you think may be important for your parenteral nutrition care plan.

- **Age:** 76-year-old female
- **HPI:** chest pain, severe SOB
- **Admission:** 3 days ago – severe mitral regurgitation
- **PMHx:** Severe peripheral vascular disease (PVD), abdominal aortic aneurysm (AAA) repair 1991, superior mesenteric artery (SMA) stent 2013
- **Operations/ Procedures:** OR on day 2 – mitral valve repair (MVR) and coronary artery bypass graft (CABG×2), PICC line inserted today
- **Consultations:** RD consult for initiation of TPN
- **Infusions:** IV Normal Saline (NS) @ 10 mL/hr = 240 mL/day, NGT in situ (for drainage of gastric contents and trial of enteral feeds)
- **Medications** (via triple lumen catheter or NGT):

- Docusate sodium 100 mg **BID**
- Sennosides 17.2mg @ 1000 h
- Magnesium Hydroxide 30mL @ 1000 h
- Pantoprazole 40 mg IV @1000 h
- Furosemide 20mg IV BID
- Amiodarone 300 mg IV @ 2200 h

When reviewing medications, you should always have knowledge of what each one is used for and why your patient may be on them even if it does not directly affect your care plan.

- **Docusate Sodium:** stool softener, used to prevent/treat constipation.
- **Sennosides (or Senna):** used to treat constipation and empty the large intestine.
- **Magnesium Hydroxide:** reduces stomach acid and increases water in the intestines which may induce bowel movements. Used as a laxative to relieve constipation or as an antacid.
- **Pantoprazole:** a proton pump inhibitor used to decrease acid production in the stomach. It helps prevent stress ulcers.
- **Furosemide (Lasix):** a diuretic used to treat edema and promote urinary fluid loss. It will cause potassium losses in the urine.

- **Amiodarone:** antiarrhythmic medication used to treat and prevent irregular heartbeats.

## Poppy's Head-to-Toe Assessment Data

Here is an example of the head-to-toe assessment method.

### Head-to-toe assessment data for Poppy

System	Poppy's assessment data
Neurological (CNS)	Decreased <b>LOC</b> , does not obey, is protecting airway
Respiratory (Resp)	Extubated, on 2L NP, RR 18, SpO <sub>2</sub> 98%
Cardiovascular (CVS)	Hemodynamically stable
Gastrointestinal (GI)	Distended abdomen, abdominal pain, dietary order is <b>NPO</b> , NGT in situ
Genitourinary (GU)	1560mL/24hrs urine output, evidence of fluid overload (++), on diuretic (furosemide)
Infectious Disease	Afebrile
Physical Assessment	Edema in hands and feet, evidence of lean body mass wasting (temporal pitting)

Poppy has been extubated from the mechanical ventilator but remains in the ICU due to being fluid overloaded and having a low level of consciousness. Consider what this may suggest and how these factors may impact your nutrition care plan.

# Anthropometric Data

## Assessment of Body Weight

Body weight is the most used indicator of nutritional status, as it is used for calculating fluid, protein, and energy requirements. It is important to consider if the weight you are using needs to be adjusted for fluid retention or if the patient has an amputation. For the most accurate estimations, using a weight as close to a “dry weight” is best.

Obtaining height and age is often necessary to further interpret body weight. Body Mass Index (BMI) is commonly used as a classification to evaluate health risk. However, Master’s tables are used to determine ideal body weight in adults aged 65+.

**Master’s Table indicating average weight ranges for women, by height and five-year age group**  
Adapted from the Sunnybrook Clinical Nutrition Resource Handbook

Height	Five-Year Age Groups		
	65–69 years	70–74 years	75–79 years
147 cm	54.4–66.2 kg	50.8–62.6 kg	50.3–61.2 kg
150 cm	54.9–66.7 kg	51.7–63.5 kg	50.8–61.7 kg
152 cm	55.3–67.1 kg	52.6–64.4 kg	51.3–63.1 kg
155 cm	55.8–68.5 kg	53.5–65.3 kg	52.2–64.0 kg
157 cm	56.7–69.4 kg	54.9–66.7 kg	53.5–65.3 kg
160 cm	57.6–70.3 kg	55.8–68.5 kg	54.9–66.7 kg

It is also important to use other markers of weight, including % weight change and % usual body weight during your assessment to further evaluate your patient’s weight. The calculations in the tables below will help you interpret the findings in regard to severity and indication of malnutrition.

**% of weight loss, by time frame and severity**  
 $\% \text{ weight loss} = (\text{usual body weight} - \text{current weight}) \times 100$   
*Adapted from the Sunnybrook Clinical Nutrition Resource Handbook*

Time Frame	Significant Weight Loss (%)	Severe Weight Loss (%)
<b>1 week</b>	1-2	> 2
<b>1 month</b>	5	> 5
<b>3 months</b>	7.5	> 7.5
<b>6 months</b>	10	> 10
<b>Unlimited time</b>	10-20	> 20

**% Usual Body Weight (UBW), with malnutrition interpretations**  
 $\% \text{ UBW} = (\text{current body weight} \div \text{usual body weight}) \times 100$   
*Adapted from the Sunnybrook Clinical Nutrition Resource Handbook*

UBW range (%)	Interpretation
85 – 95	May indicate mild malnutrition
75 – 84	May indicate moderate malnutrition
< 74	May indicate severe malnutrition

## Poppy's Anthropometric Data: Body Weight

- **Age:** 76 years old
- **Height:** 160 cm
- **Current weight, pre-operative:** 63 kg
- **Current weight, post-operative:** 73 kg (+10 L of fluid)

- **Usual weight:** 68 kg (1 month prior to admission)
- **Timeframe of weight loss:** 1 month
- **Master's Table evaluation:** within range
  - 54.9–66.7 kg is average weight range for women of Poppy's height and age
  - Therefore, Poppy's pre-operative weight of 63 kg is within range
  - However, we still need to consider weight in the context of other factors such as her recent weight loss
- **% UBW:** 92.6%
  - *Calculation:*  $(63\text{kg} \div 68\text{kg}) \times 100 = 92.6\%$
- **% weight loss:** 7.4%
  - *Calculation:*  $[(68\text{kg} - 63\text{kg}) \div 68\text{kg}] \times 100 = 7.4\%$



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=148#h5p-54>

# Nutritional Requirements

## Energy Requirements

Predictive equations are for estimation purposes only. The most accurate data will provide the most accurate estimation, but without indirect calorimetry this is the best we can achieve. As a result, there is a need for frequent re-assessment of energy requirements.

Factors affecting the accuracy of estimated requirements include:

- Acute or chronic respiratory distress syndrome
- Large open wounds or burns
- Malnutrition with altered body composition
- Underweight, obesity, limb amputation, peripheral edema, ascites
- Multiple or neurological trauma
- Multisystem organ failure
- Postoperative organ transplantation
- Sepsis
- Systemic inflammatory response syndrome
- Paralytic or barbituate agents

## Predictive Equations

Here are three commonly used predictive equations. There are other predictive equations you may use, depending on your area of practice. **Accuracy varies by equation and population.** Experience is helpful for an accurate selection and utilization of these predictive equations.

### Abbreviations:

- EER = estimated energy requirements
- REE = resting energy expenditure (kcal)
- A = age (years)
- PA = physical activity
- W = weight (kilograms)
- H = height (centimetres, unless otherwise specified)
- H\* = height (metres)

- Dietary Reference Intakes (DRI)
  - EER: age, physical activity, weight, height
  - Males:  $EER \text{ (kcal)} = 662 - 9.53A + PA \times (15.91W + 549.6H^*)$
  - Females:  $EER \text{ (kcal)} = 354 - 6.91A + PA \times (9.36W + 726H^*)$
- Harris Benedict (HB)
  - REE: weight, height, age
  - Males:  $REE \text{ (kcal)} = 66.5 + 13.75W + 5.0H - 6.78A$
  - Females:  $REE \text{ (kcal)} = 655.1 + 9.56W + 1.85H - 4.68A$
- Mifflin-St.Jeor (MSJ)
  - REE: weight, height, age
  - Males:  $REE \text{ (kcal)} = 9.99W + 6.25H - 4.92A + 5$
  - Females:  $REE \text{ (kcal)} = 9.99W + 6.25H - 4.92A - 161$
- Estimated Calories/kg

### *Specific Predictive Equations for Critically Ill Patients*

If you are working with critically ill patients, it is important to be aware of the different methods of energy estimation. In your

practicum, you may notice different formulas being used, and even different ranges depending on the situation. Clinical judgement takes time to develop, and these equations are meant to help guide you.

One method involves calculating the **calories per kilogram** of body weight. The calculation may change depending on a patient's BMI, as detailed below.

- **BMI 18.5-24.9, vented:** 15-40 kcal/kg actual wt (varies based on patient population)
- **Obese critically ill, vented:** BMI 30-50 = 11-14 kcal/kg actual wt/day; BMI >50 = 22-25 kcal/kg IBW

A second method used for critically ill patients is the **Penn-State Equation**. Similarly to calculating calories per kilogram, the Penn-State Equation varies by BMI and also patient age (as detailed below).

- **Original:** Mifflin equation(0.96) + Tmax(167) + Ve(32) – 6212
- **Modified for use in patients > 60 years, with BMI >30:**  
Mifflin(0.71) + Tmax(85) + Ve(64) – 3085
- **Note:** Use actual weight for Mifflin equation; Ve = minute ventilation at time of Tmax

## Activity Factors

Most predictive equations evaluate resting energy expenditure (REE), meaning you need to consider physical activity energy expenditure in addition to the original calculation. The activity factor (AF) is applied to the REE value. Activity factors are not to be used with DRI equations.

**Activity Factors (AF) for various activity levels**  
 [\*] indicates activities obtained in healthy, free-living people  
 Adapted from the Sunnybrook Clinical Nutrition Resource Handbook

Activity Level	AF
<b>*Resting (lying or sitting)</b>	<b>1.0 – 1.4</b>
Lying still, sedated or asleep	0.9 – 1.1
Lying still, conscious	1.0 – 1.1
Spinal cord injury, 0-4 weeks post-injury	1.1
Bedrest (moving self around bed)	1.15 – 1.2
Mobilizing occasional on ward	1.15 – 1.4
<b>*Sedentary/ Light Activity (standing for long periods)</b>	<b>1.4 – 1.6</b>
Mobilizing frequently on ward	1.4 – 1.5
Regular, intensive physiotherapy	1.5 – 1.6
<b>*Moderate Activity (continuous movement/slow walking)</b>	<b>1.6 – 1.8</b>

## Stress Factors

Most predictive equations evaluate resting energy expenditure (REE), meaning you may need to consider energy expenditure from stress. The stress factor is applied to the REE value.

**Stress Factors (SF) for various clinical statuses**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

<b>Clinical Status</b>	<b>SF</b>
Cancer	0.8 - 1.5
Elective surgery	1.0 - 1.1
Peritonitis	1.05 - 1.25
Multiple/ long bone fractures	1.1 - 1.3
Fever	1.2 per 1°C > 37°C
Spinal cord injury, 0-4 weeks post-injury	1.2
Sepsis	1.2 - 1.4
Severe infection	1.2 - 1.6
Burns	1.2 - 2.0
Infection with trauma	1.3 - 1.55
Multiple trauma, traumatic brain injury	1.4

## Protein Requirements

This table represents general guidelines for protein requirements according to how hypermetabolic your patient is. Consider your individualized patient to determine the most accurate protein requirement. Experience using these methods is helpful. You can consider calculating requirements using various methods and compare values.

**General protein requirements, by patient's hypermetabolic category**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

Patient Category	Protein (g/kg)
Not hypermetabolic: <ul style="list-style-type: none"> <li>• Adults not severely ill or injured</li> <li>• Adults not at risk of refeeding syndrome</li> <li>• Acute elderly patients</li> </ul>	0.8 – 1.5  (1.0 – 1.5 for acute elderly patients)
Moderately hypermetabolic, including: <ul style="list-style-type: none"> <li>• Post-operative (~14 days)</li> <li>• Repletion</li> <li>• Infection</li> <li>• Temperature &gt; 38°C</li> <li>• Head injury</li> <li>• COPD exacerbation</li> </ul>	1.2 – 1.5
Hypermetabolic, including multi-trauma	1.5 – 2.0

The following table represents a more detailed overview of protein requirements specific to various clinical conditions. This may be more useful for you during practice than the general guidelines, if your patient's clinical status is reflected in this table.

**Detailed protein requirements, by patient's clinical status  
Adapted from the Sunnybrook Clinical Nutrition Resource  
Handbook**

<b>Clinical Status</b>	<b>Protein (g/kg)</b>
Normal (non-stressed, non-depleted)	0.8 – 1.0
Postoperative	1.0 – 1.5
Sepsis	1.5 – 2.0
Multiple trauma	1.3 – 1.7
Traumatic brain injury	1.2 – 2.0
Burns	1.2 – 2.0
Catabolism	1.2 – 2.0
Refeeding syndrome	1.2 – 1.5
Cancer	0.8 – 2.0
Hemodialysis	1.1 – 1.2
CCPD/CAPD	1.2 – 1.3
CRRT	1.5 – 2.0
Acute Renal Failure	1.0 – 1.5
Chronic Kidney Disease	0.8 – 1.0
Mild-Moderate Stress	1.2 – 1.3
Moderate-Severe Stress	1.5 – 2.0
Severe + Wound Healing	1.5 – 2.0
HIV (asymptomatic)	1.0 – 1.4
HIV (symptomatic)	1.5 – 2.0
HIV (CD4 < 200/AIDS defining condition)	2.0 – 2.5

## Fluid Requirements

This table represents general guidelines for calculating fluid requirements. Consider your individual patient prior to determining the best method to use. Experience using these methods is helpful.

You can calculate requirements using various methods and compare values.

**General guidelines for fluid requirements  
Adapted from the Sunnybrook Clinical Nutrition  
Resource Handbook**

Based Upon	Method of Fluid Estimation
Weight	<ul style="list-style-type: none"> <li>• 100 mL/kg for 1st 10 kg</li> <li>• 50 mL/kg for next 10 kg</li> <li>• 20 mL/kg for each kg &gt; 20 kg</li> </ul>
Energy	1 mL per kcal
Age and weight	<ul style="list-style-type: none"> <li>• 16 – 30 years, active: 40 mL/kg</li> <li>• 20 – 55 years: 35 mL/kg</li> <li>• 55 – 75 years: 30 mL/kg</li> <li>• &gt; 75 years: 25 mL/kg</li> </ul>
Fluid balance	Urine output + 500 mL/day

## Electrolyte Requirements

This table provides an example of general guidelines for electrolyte requirements. Be sure to take your patient’s current bloodwork and clinical status into consideration prior to determining their electrolyte requirements. Electrolyte requirements can vary tremendously based on the clinical situation.

### General guidelines for electrolyte requirements

Electrolyte	Daily requirements	Factors that increase needs
<b>Sodium</b>	1 - 2 mmol/kg	Diarrhea, vomiting, GI losses
<b>Potassium</b>	1 - 2 mmol/kg	Diarrhea, vomiting, medications, refeeding syndrome, GI losses
<b>Calcium</b>	5 - 7.5 mmol/day	High protein intake
<b>Magnesium</b>	4 - 10 mmol/day	Medications, refeeding syndrome, GI losses
<b>Phosphorous</b>	20 - 40 mmol/day	High dextrose loads, refeeding syndrome

## Biochemical Data

### Laboratory Values

In the hospital, you will have access to a variety of laboratory values. The table below represents common laboratory values to review for all patients. Depending on your patients diagnosis, you may have to review additional values.

### Common laboratory values

Laboratory Value	Normal Range
WBC	4.00 – 11.00 E9/L
Glucose (Random)	4.0 – 7.8 mmol/L
Sodium (Na <sup>+</sup> )	135 – 145 mmol/L
Potassium (K <sup>+</sup> )	3.5 – 5.0 mmol/L
Chloride (Cl <sup>-</sup> )	96 – 106 mmol/L
Phosphorus (PO <sub>4</sub> )	0.8 – 1.35 mmol/L
Calcium (Ca <sup>2+</sup> )	2.1 – 2.1 mmol/L
Magnesium (Mg <sup>2+</sup> )	0.63 – 0.94 mmol/L
Albumin (Alb)	35 – 50 g/L
Blood Urea Nitrogen (BUN)	3.0 – 7.0 mmol/L
Creatinine (Cr)	44 – 80 μmol/L

## Poppy's Biochemical Data

Review Poppy's biochemical data and make note of values highlighted in red.

### Poppy's laboratory values

[\*] Indicates values outside the target range

Laboratory Value	Poppy's labs
White blood cell count (wbc)	*14.7 $10^9$ /L
Hemoglobin (Hgb)	*95 g/L
Glucose (BG)	6.2 mmol/L
Sodium ( $\text{Na}^+$ )	*132 mmol/L
Potassium ( $\text{K}^+$ )	4.9 mmol/L
Chloride ( $\text{Cl}^-$ )	107 mmol/L
Phosphorus ( $\text{PO}_4$ )	1.33 mmol/L
Calcium ( $\text{Ca}^{2+}$ )	2.20 mmol/L
Magnesium ( $\text{Mg}^{2+}$ )	*1.0 mmol/L
Albumin (Alb)	*25 g/L
Blood Urea Nitrogen (BUN)	*9.8 mmol/L
Creatinine (Cr)	*121 $\mu\text{mol/L}$

Here is a general assessment of Poppy's biochemical data. It is important to understand why values are not in the normal range in the context of the patients clinical status.

- **WBC:** Elevated, may indicate development of an infection or tissue damage. An infection may further increase Poppy's metabolic rate.
- **Hemoglobin:** Low, likely multifactorial: blood loss during surgery, bone marrow suppression due to

renal failure and malnutrition. Her history does not suggest she is actively bleeding anywhere.

- **Sodium:** Low, likely hypervolemic hyponatremia due to fluid retention causing dilution of sodium in the blood. It is not low due to sodium loss – but instead it is reflecting her fluid status (i.e. overloaded).
- **Glucose:** Within normal limits for ICU. Insulin infusion may be started if glycemic control is inadequate.
- **BUN:** Elevated due to acute kidney injury (AKI)/renal failure.
- **Creatinine:** Elevated due to AKI/renal failure. Note that the creatinine level has almost doubled over her baseline level in a matter of days. This is an indication of acute kidney injury due to decreased perfusion of blood to the kidneys during cardiovascular surgery.

## Poppy's Nutrition Requirements

- Consideration for requirements: post op cardiovascular surgery, critical illness, sepsis, AKI, catabolic
- Use preoperative weight 63 kg due to current fluid

overload (+ 10 L)

- Caloric requirements (calories/kg): 25 – 30 kcal/kg  
× 63 kg = 1575 – 1890 kcal/day
  - Poppy's Energy Requirements: 1575 – 1890 kcal/day (25 – 30 kcal/kg/day)
- Protein requirements: range from 1.2 – 1.5 g/kg (you should look up factors to be aware of for the assessment of AKI).
  - Poppy's Protein Requirements: 76 – 95 g/day (1.2 – 1.5 g/kg)
- Fluid requirements: 25 – 30 mL/kg x 63 kg = 1575 – 1890 mL/day
  - Poppy's Fluid Requirements: 1575 mL/day (25 mL/kg) – as conservative as possible
  - Consideration for Fluid: MD orders (did they specify a fluid target?), ongoing diuresis? As mentioned prior, limiting fluid is a priority.

When calculating energy requirements, Poppy's preoperative weight will be used. Calories per kilogram is commonly used in the ICU and other areas of practice. It requires clinical judgement of the patient's status; however you can always calculate energy requirements using multiple methods to compare when you are learning to use these equations. Considerations for Poppy's energy requirements are that she is post operative and experiencing critical illness.

Poppy's protein requirements should range from 1.0-1.5 g/kg as she is post operative and experiencing acute

kidney injury (AKI). Fluid needs to be minimized as much as possible.

Negotiate a fluid allowance with the Intensivist and/or Nephrologist. Sometimes due to the condition of the patient, they may only want 1 L total fluid per day. A positive fluid balance of 10 L is very high. The electrolytes that need to be addressed are: sodium, potassium, calcium, magnesium and phosphorus.

The initial parenteral nutrition solution may need to be electrolyte free because Poppy's electrolytes are elevated. Liaise with the pharmacist/intensivist/nephrologist to avoid her blood levels from becoming dangerously elevated.

## IV Solutions

Here is an overview of common IV solutions used in hospital. It is important to review which IV solution(s) your patient is receiving as it could be providing a patient with energy/ dextrose. Different IV solutions are also chosen in various clinical scenarios. This needs to be considered when you are creating a nutrition care plan.

**Common IV solutions**  
Adapted from the Sunnybrook Clinical Nutrition Resource Handbook

<b>Solution</b>	<b>Kcal/L</b>	<b>Composition/L</b>
<b>Normal Saline (0.9% NaCl)</b>	0	Na - 154 mmol Cl - 154 mmol
<b>½ Normal Saline (0.45% NaCl)</b>	0	Na - 77 mmol Cl - 77 mmol
<b>D5W (5% Dextrose)</b>	170	Dextrose - 50 g
<b>D10W (10% Dextrose)</b>	340	Dextrose - 100 g
<b>5% Dextrose and 0.9% NaCl</b>	170	Dextrose - 50 g Na - 154 mmol Cl - 154 mmol
<b>⅔ and ⅓ (3.3% Dextrose and 0.3% NaCl)</b>	112	Dextrose - 33 g Na - 51 mmol Cl - 51 mmol
<b>Ringer's Lactate</b>	9	Na - 130 mmol K - 4 mmol Ca <sup>2+</sup> - 1.4 mmol Cl - 109 mmol Lactate - 28 mmol

## Poppy's IV Solution

Poppy is currently receiving IV NS @ 10cc/hr = 240cc/d.  
Normal saline does not contribute any calories for Poppy.

However it does contribute a small amount of Na (37 mmol) and Cl (37 mmol).

## Dietary Data

Obtaining accurate dietary data can vary based on your patient (e.g. family members present, patient's cognitive ability, flow sheets or calorie counts, etc.), as well as the setting (e.g. inpatient compared to outpatient).

If possible, collect the following information:

- **Diet order(s):** Important for a representation of daily intake while in the hospital (can include enteral nutrition & supplements).
- **Dietary recall:** 24 hour recall (if recent admission or representation of food consumption in hospital), common eating patterns, or short-term and long-term representation of eating patterns or typical foods.
- **Calorie counts:** Depending on the patient, you may order calorie counts to monitor/determine how much/what they are eating in hospital.

## Poppy's Dietary Data

Prior to hospital admission she had been living with her sister, Esther, in an apartment. Poppy was starting to have difficulty mobilizing due to her shortness of breath. She had not been eating well for weeks and had lost ~5 kg of weight during that time frame. Esther summarizes Poppy's usual daily intake for the past few weeks.

### Dietary Recall for Poppy

- **Breakfast:** 1 cup of tea with milk, 1 piece of whole grain toast with butter and jam
- **Lunch:** 1 bottle of Ensure
- **Afternoon snack:** ½ banana, 1 cup of tea with milk
- **Dinner:** 1 small chicken breast, ½ cup potato, ½ cup vegetables, 1 cup of tea with milk

Energy intake ~965 kcal/day and protein intake ~45 g/day. Poppy is not consuming an adequate amount for her height, weight and age. Her suboptimal oral intake is contributing to her weight loss.

Because Poppy's diet history is nutritionally inadequate and suggests suboptimal preoperative nutritional status, it is important to note that this can affect her postoperative outcome.

## Poppy's Current Dietary Order and Plan

The Intensivist requested that Poppy start enteral feeding as there is good evidence to support early feeding in ICU patients.

**Enteral order**, as per the ICU enteral feeding protocol: Isosource 1.5 @ 10 mL/hr × 24 hrs/day via NGT. This is considered a “trickle feed” as it does not provide extensive nutrition but is used to stimulate the gut.

**Complications:** Within 8 hours Poppy started complaining of diffuse abdominal pain and her nurse noticed increased abdominal distension. Her enteral feeds are held, and a computed tomography (CT) of the abdomen is ordered.

**CT Findings:** Contrast-enhanced transverse CT scan shows ischemia of the distal ileum, with pronounced bowel wall thickening and mesenteric fat stranding. No bowel obstruction.

**Outcome/ Assessment:** The Intensivist does not want Poppy fed enterally, so you are asked to assess for TPN. The physicians are concerned about her fluid status as it will negatively impact her respiratory status. **Important: They want you to limit fluid in your nutrition care plan.**

## Practice your Enteral Feeding Skills

Recall that Poppy received Isosource 1.5 @ 10 mL/hr for 8 hours, before her enteral feeds were held.

The table below contains values taken from the [Isosource 1.5 nutrition panel](#).

**Nutrient Analysis (per mL of Isosource 1.5)**

	<b>Ener gy</b>	<b>Prot ein</b>	<b>F at</b>	<b>Carbohydr ate</b>	<b>Wa ter</b>	<b>Sodi um</b>	<b>Potassi um</b>	<b>n</b>
<b>Unit</b>	Kcal /mL	g/ mL	g /mL	g/mL	mL	mg	mg/ mmol	
<b>Amo unt (per mL)</b>	1.5	0.06 8	0. 06	0.17	0.7 6	1.3	2.4/ 0.06	



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=148#h5p-55>

## Refeeding Syndrome

Refeeding syndrome is a concern for any patient who has been without consistent or adequate nutrition for a prolonged period. It is a series of metabolic events that occur as a result of reinstatement of nutrition (carbohydrates) to patients who are starved or severely malnourished. Refeeding syndrome is characterized by low potassium, magnesium, and phosphate with/or without fluid retention.

Serious complications can be avoided by:

- Thorough nutritional assessment
- Appropriate identification of patients at risk
- Slow initiation of feeding
- Careful monitoring

The table below outlines complications of refeeding syndrome.

**Complications of refeeding syndrome**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

	<b>Hypophosphatemia</b>	<b>Hypokalemia</b>	<b>Hypomagnesemia</b>
<b>Cardiac</b>	Arrhythmia, CHF, cardiomyopathy, decreased blood pressure	Arrhythmia, cardiac arrest, EKG changes	Arrhythmia, increased heart rate
<b>Neurological</b>	Altered mental status, paralysis, seizures	Weakness, paralysis, lethargy/confusion	Altered LOC, weakness, seizures, tremors
<b>Respiratory</b>	Respiratory failure, ventilator dependence	N/A	N/A
<b>Skeletal</b>	Rhabdomyolysis, weakness	N/A	N/A
<b>Metabolomic</b>	N/A	Metabolic alkalosis	Hypokalemia, hypocalcemia
<b>Gastrointestinal</b>	N/A	Paralytic ileus, constipation	Abdominal pain, diarrhea, constipation, anorexia

An additional refeeding complication is hyponatremia secondary to hyperglycemia, which can result in: heart failure, arrhythmia, respiratory failure, pulmonary edema, renal failure, muscle cramps, fatigue, fluid retention, swelling/edema.

Risk factors for refeeding syndrome include:

- Suboptimal or no nutritional intake for > 5 days
- Postoperative
- Elderly with multiple comorbidities and decreased physiological reserve
- Cancer diagnosis
- Chronically malnourished: anorexia nervosa, chronic alcoholism, marasmus, prolonged fasting or low energy diet, morbid obesity with profound weight loss, malabsorptive syndrome (i.e. IBS, chronic pancreatitis, short bowel syndrome), high electrolyte losses (i.e. diarrhea, high output

fistula, vomiting)

- Uncontrolled diabetes (i.e. electrolyte depletion, diuresis)
- Long term use of antacids
- Long term use of diuretics
- BMI <18.5
- Ongoing unintentional weight loss

## Poppy's Risk of Refeeding Syndrome

- Poppy is at low- moderate risk of refeeding syndrome.
- Although she has lost some weight preoperatively, she is not cachectic, and was eating a moderate amount of food prior to her surgery.
- She has gone without nutrition support for 3 days. If she does demonstrate refeeding syndrome it may present late due to her AKI/renal failure. Monitor her blood work for electrolyte shifts particularly phosphorous, potassium, magnesium and blood glucose.

# Assessment Summary

## Summary of Poppy's Assessment Data

Review the final summary for Poppy's assessment data. In practice, it is good to have a summary of this information with you at all times and to keep track of the progression of your patient.

### Summary of Poppy's Assessment Data

Area	Key Data
Clinical Data	<ul style="list-style-type: none"> <li>76-year-old female admitted 1 week ago with chest pain, severe shortness of breath (SOB), and severe mitral regurgitation</li> <li>Post-operative (on day 2 of admission) – MVR and CABG×2</li> </ul>
Medications and Infusions	<ul style="list-style-type: none"> <li>NS @ 10 mL/hr = 240 mL/day</li> <li>Receiving a diuretic (furosemide)</li> </ul>
Head to Toe	<ul style="list-style-type: none"> <li>Extubated, on 2L NP, RR 18, O<sub>2</sub> sat 98%</li> <li>Distended abdomen, abdominal pain, NGT in situ</li> <li>Evidence of ~10 L fluid overload, 1560 mL/24 hr urine output</li> <li>Edema in hands and feet</li> <li>Evidence of lean body mass (LBM) wasting</li> </ul>
Anthropometrics	<ul style="list-style-type: none"> <li>Height 160 cm</li> <li>Weight 73 kg post-operatively (+ 10 L fluid) – 63 kg preoperative</li> <li>7.4% weight loss in 1 month – severe weight loss</li> </ul>
Requirements	<ul style="list-style-type: none"> <li>Energy: 1575-1890 kcal/day (25-30 kcal/kg/day)</li> <li>Protein: 76-95 g/day (1.2-1.5 g/kg/day)</li> <li>Fluid: 1575 mL/day (25 mL/kg/day) – as conservative as possible</li> </ul>
Laboratory	<ul style="list-style-type: none"> <li>Electrolytes normal – sodium slightly below normal (132 mmol/L)</li> <li>Creatinine/BUN elevated</li> </ul>

Dietary	<ul style="list-style-type: none"><li>• NPO – re: doctors orders and intolerance to EN – plan to start TPN via PICC line</li><li>• Received 80 mL of EN → pain and distension → feeds stopped</li></ul>
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PART 1: ASSESS COMPLETE. Please take a few minutes to think about the assessment strategies discussed and the data collected. When you're ready, move on to Part 2: Plan.

# Plan



## Team Rounds

Team rounds are an opportunity to collaborate and communicate with the interdisciplinary team. You may update the team about your patient's care plan and gather important information on their diagnosis, prognosis, consults, current status, expected progression, next steps and disposition planning.



A doctor, nurse, and other medical staff are pictured conducting rounds in a hospital.

*Photo by [Madailein Abbott](#) is licensed under [Public Domain](#).*

## Poppy's PN Plan

When a dietitian is asked to assess a patient for PN, the first question should be “Is PN appropriate for this patient?” PN is an invasive, expensive and high-risk treatment compared to other methods of feeding.

In making your decision, consider the following about Poppy:

- She is not tolerating EN.
- She is critically ill (catabolic), with an acute kidney injury, and has lost a significant amount of weight preoperatively.
- Her history of severe PVD may contribute to a prolonged period of poor tolerance to enteral nutrition.

These factors coupled with inadequate nutrition support postoperatively may increase the chance of poor outcomes, morbidity and mortality.

Therefore, Poppy is appropriate for parenteral nutrition support.

## Timing of PN Initiation

Initiation of parenteral nutrition may differ based on clinical indication and severity of malnutrition. It is common practice to initiate PN sooner for patients who are malnourished and are unable to meet their estimated nutrition requirements with oral intake or enteral nutrition. Other factors may also influence initiation of PN. However, general guidelines regarding initiation of PN are listed below.

- For **well-nourished, stable** patients: Initiate parenteral nutrition after 5 to 7 days if unable to receive > 50% of estimated requirements orally or enterally.
- Patients who are **nutritionally-at-risk** and unlikely to achieve adequate oral or enteral intake: Initiate parenteral nutrition within 3 to 5 days.
- In patients with **baseline** moderate or severe malnutrition and insufficient or unattainable oral or enteral intake: Initiate parenteral nutrition as soon as possible.
- For patients with **severe metabolic instability**: Delay initiation of parenteral nutrition until their condition has improved.

## Reminder of PN Formulations

### Macronutrients

The energy that is provided from macronutrients in PN is slightly different than the energy provided in other forms of nutrition (i.e. enteral formulas, food, beverages). Please note the differences

below and ensure you use the correct values when determining your PN care plan.

Caloric contributions of macronutrients:

- **Protein:** 1 g amino acid = 4.0 kcal
- **Carbohydrate:** 1 g dextrose = 3.4 kcals
- **Lipid:** 1 g lipid = 10 kcals

## Lipids

Depending on your hospital formulary, you may have access to various lipid emulsions. These emulsions vary in omega-3, 6 and 9 content. You should seek further readings regarding the use of various lipid emulsions and the associated advantages, disadvantages, and possible situations that they may be used in.

- **Intralipid:** made of safflower or soybean oil + glycerol emulsifier + phospholipid (egg) and available as 10%, 20% & 30%
- **SMOFlipid:** soybean oil, medium chain triglycerides (MCT), olive oil, and fish oil (6%/6%/5%/3% w/v)
- **Omegavan:** purely fish oils, DHA, EPA
- **ClinOleic:** olive oil

**Lipid emulsion concentrations**

Lipid Emulsions	Omega-3	Omega-6	Omega-9	Saturated	MCT
<b>Soybean oil emulsion</b>	5%	60%	20%	15%	–
<b>Olive-soybean oil mixture</b>	3%	20%	60%	17%	–
<b>Fish oil emulsion</b>	60%	10%	10%	20%	–
<b>SMOF emulsion</b>	10%	20%	30%	10%	30%

## Micronutrients

Vitamins, minerals, and trace elements should be included in parenteral nutrition solutions as depletion of a compromised patient's micronutrient reserves could impair the patient's ability to absorb and utilize nutrients.

Electrolytes are also added to PN solutions. Unlike vitamins, minerals and trace elements, electrolytes must be adjusted daily in a patient who is starting PN to account for losses, disease effects and organ function.

There are guidelines which govern how much calcium and phosphorus can be given to avoid precipitates. Acetate is added to buffer acid from amino acids as bicarbonate cannot be added. Large electrolyte deficiencies must be corrected by IV boluses (ordered by the MD/NP) prior to initiating PN or advancing solutions. Institutional formularies will determine which micronutrients are available and training should be provided to ensure safe delivery to patients.

Here is a sample electrolyte regimen for a stable patient receiving PN:

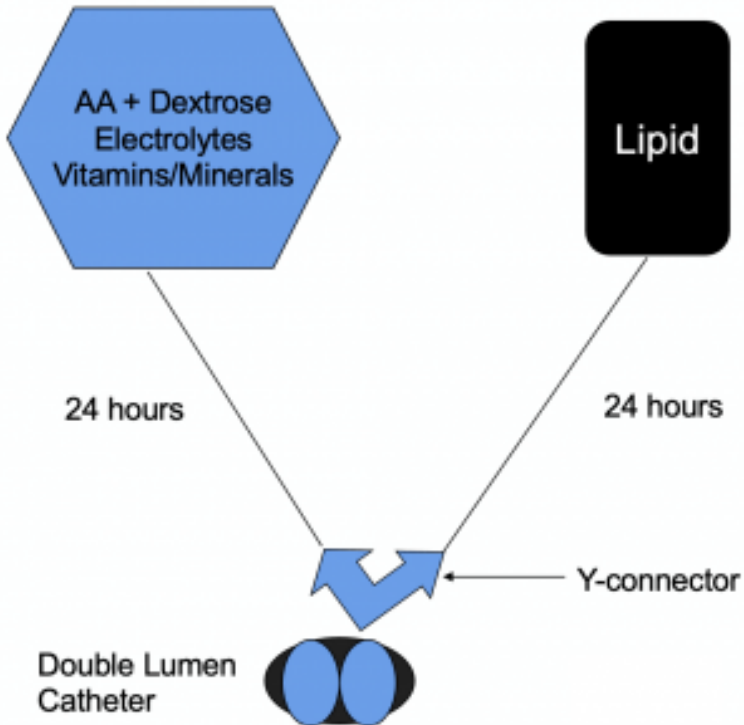
- **Na:** 80 – 120 mmol/day – with chloride, acetate
- **K:** 40 – 80 mmol/day – with chloride, phosphate or acetate
- **Mg:** 10 – 15 mmol/day – as sulfate salt
- **PO<sub>4</sub>:** 8 – 16 mmol/day – with Na or K

## PN Procurement

PN is compounded in hospital pharmacy. Solutions may be individualized or standardized formulas, depending on the institution.

There are two types of PN procurement:

- “3-in-1” AA/dextrose/lipid/electrolytes in one bag
- “2-in-1” AA/dextrose/electrolytes + lipid in a separate bag.



*Illustration of a 2-in-1 PN procurement. A double lumen catheter has a y-connector leading to two bags: 1. amino acids, dextrose, electrolytes, vitamins and minerals; 2. Lipid.*

Some hospitals have a pre-determined **standardized formulary** for ease of ordering and preparing PN. The pre-determined formulas are all named and vary in macronutrient volumes. Additives are individualized based on patients’ needs. The RD chooses the solution which closely matches the patient’s requirements. Here is an example of a standardized bag order form: [Sample PN Formulary \(PDF\)](#).

Some hospitals have **individualized formulas** which are prepared for a specific patient. If the hospital has a variety of solutions available, the RD can customize the PN formula to very closely match a patient's estimated requirements. If there is a limited number of solutions, the PN formula may not be ideal to meet each estimated requirement.

It is possible that some hospitals may have both standardized and individualized formularies. If a standardized formula is not appropriate, the RD would calculate a custom solution.

## PN Administration

When a patient is started on PN, it generally takes about 2 - 4 days to achieve goal volumes while monitoring metabolic tolerance. However, this may differ for specific patients:

- Patients who are very malnourished or show signs and symptoms of refeeding syndrome may take up to 7 days to safely receive goal volumes. Electrolytes, fluid and dextrose may need several steps of adjustment before a patient receives their goal nutrition provision.
- For patients who have diabetes or elevated blood glucose levels, it may take several days to adjust the patient's insulin regime for acceptable glycemic control.

It is common for routine bloodwork to be drawn to monitor metabolic tolerance pre-PN and day 1, 2, 3 after starting PN. Typically after a patient has been stable on their goal volume of PN, bloodwork is drawn once or twice a week according to the institution's protocol (unless the patient's medical condition requires a different monitoring schedule).

When starting PN, it is usually given over 24 hours. Patients who require long-term PN have their delivery cycled to fewer hours to

provide freedom from the IV pump/pole and improve quality of life (QOL). PN would be given over 20 hours a day, followed by 16 hours a day, followed by 12 hours a day.

## Poppy's Parenteral Regime: Formula Selection

### **Take note of Poppy's estimated requirements:**

- Weight: 63 kg
- Energy: 1575-1890 kcals/day
- Protein: 76-95 g/day
- Fluid: very conservative

The first step in determining Poppy's parenteral plan is to select a solution. As mentioned, depending on your hospital, you will have access to different amino acid, dextrose and lipid solutions. In this case, we have access to a 5% amino acid solution, and varying dextrose solutions of 10%, 16.6%, and 25%. You can determine the energy content of each TPN solution by calculating the gram amount of amino acid and dextrose in 1L of solution.

Depending on your patients needs, you can select a less or more concentrated solution.

**Pause and consider which of the solutions you would choose, based on Poppy's requirements:**

- A. 5% amino acid (aa) + **10% dextrose** (dex)
  - $50 \text{ g aa} \times 4 \text{ kcal/g} = 200 \text{ kcal}$
  - $100 \text{ g dex} \times 3.4 \text{ kcal/g} = 340 \text{ kcal}$
  - $1 \text{ L TPN} = 540 \text{ kcal}$
  
- B. 5% amino acid + **16.6% dextrose**
  - $50 \text{ g aa} \times 4 \text{ kcal/g} = 200 \text{ kcal}$
  - $166 \text{ g dex} \times 3.4 \text{ kcal/g} = 564 \text{ kcal}$
  - $1 \text{ L TPN} = 764 \text{ kcal}$
  
- C. 5% amino acid + **25% dextrose**
  - $50 \text{ g aa} \times 4 \text{ kcal/g} = 200 \text{ kcal}$
  - $250 \text{ g dex} \times 3.4 \text{ kcal/g} = 850 \text{ kcal}$
  - $1 \text{ L TPN} = 1050 \text{ kcal}$

When starting to work through your patient's parenteral nutrition plan, it is common to start with calculating protein requirements. Clinicians use various methods to calculate a PN regime, however protein requirements are often a key factor and it is important to meet the patients needs. Therefore, it is suggested that you start by

determining a solution that meets Poppy's estimated protein requirements to avoid redoing your calculations multiple times.

### **Protein calculations**

- $76 \text{ g needed} \div 50 \text{ g (in 1 L)} = \text{need } \mathbf{1.52 \text{ bags}} = 1.52 \text{ L}$
- $1.52 \text{ L} = 50 \text{ g aa} \times 1.52 = 76 \text{ g pro} \times 4 \text{ kcal/g} = 304 \text{ kcal}$

If Poppy requires a minimum of 76 g of protein per day, this would require 1.52 L of TPN using a 5% amino acid solution. *Protein will contribute 304 calories.*

### **Carbohydrate calculations**

- $100 \text{ g dex} \times 1.52 = 152 \text{ g CHO} \times 3.4 \text{ kcal/g} = 517 \text{ kcal}$
- $\mathbf{166 \text{ g dex} \times 1.52 = 252 \text{ g CHO} \times 3.4 \text{ kcal/g} = 859 \text{ kcal}}$
- $250 \text{ g dex} \times 1.52 = 380 \text{ g CHO} \times 3.4 \text{ kcal/g} = 1292 \text{ kcal}$

Based on Poppy's needs, it is reasonable to choose the 16.6% dextrose solution.

*This dextrose solution will contribute 859 calories in 1.52 L of the solution.*

### **Lipid calculations**

- Determine calories from lipid:  $1700 \text{ kcal/day} = 1700 - (304 \text{ from protein} + 859 \text{ from CHO}) = \mathbf{537 \text{ kcal}}$   
**needed from 20% lipid**
- Determine mL of lipid:  $537 \text{ kcal} / 2 \text{ kcal/mL (20\%)} = 269 \text{ mL 20\% lipid}$
- Determine grams of lipid:  $537 \text{ kcal} / 10 \text{ kcal/g} = 54 \text{ g lipid}$

In this case, we want to have a greater caloric contribution from lipid because Poppy's fluid requirements are restricted. Including a higher amount of lipid results in a more fluid restricted solution as lipids are calorically dense.

*Poppy will receive 537 calories from lipid to meet her needs of approximately 1700 calories a day from TPN.*

Practice these calculations and review the answers.

## Poppy's Parenteral Regime: Summary of Formula Selection

Here is a summary of the formula based on 5% amino acid, 16.6% dextrose, 20% SMOlipid and standard electrolytes.

**The total amount of fluid is 1789 mL to meet Poppy's energy needs of 1700 calories a day.**

Keep in mind that you would have need to liaise with the physicians on your team to approve the fluid volume of your TPN order as they have requested that you minimize Poppy's fluid intake.

5% amino acid / 16.6% dextrose + 20%  
SMOFlipid + standard electrolytes + MVI

- 1.52 L 5% amino acid / 16.6% dextrose
  - 76 g pro / 304 kcal
  - 252 g CHO / 859 kcal
- 269 mL 20% SMOFlipid
  - 54 g fat / 537 kcal

**Total:** 1789 mL (1520 mL dextrose and AA + 269  
mL lipid) / 1700 kcal

## Macronutrient Tolerance and Distribution

After creating your PN regime, it is important to make sure your plan aligns with the guidelines for macronutrient tolerance and distribution. Pause and try calculating the macronutrient tolerance and distribution of your selected formula before moving on.

### Macronutrient tolerance and distribution

	Macronutrient tolerance	Macronutrient distribution
<b>Dextrose</b>	< 4-5 mg/kg/min	45 – 65%
<b>Lipid</b>	≤ 2.0-2.5 g/kg/day (<1.5 g/kg/day preferred) or < 30% of daily kcal	10 – 35%
<b>Protein</b>	As per estimated requirements	10 – 35%

## Poppy's Parenteral Regime: Macronutrients

### Poppy's Estimated Requirements

- Weight: 63 kg
- Energy: 1575-1890 kcal/day
- Protein: 76-95 g/day
- Fluid: very conservative

### Macronutrient tolerance

- Protein as per estimated requirements: 76 g/63 kg = 1.2 g/kg
- Lipid ≤ 2.0-2.5 g/kg/day: 54 g fat/63 kg = 0.86 g/kg

- Dextrose  $\leq$  4-5 mg/kg/min:
  - 252 g dextrose = 252000 mg
  - $252000 \text{ mg} / 63 \text{ kg} / 1440 \text{ min} = 2.8 \text{ mg/kg/min}$

For macronutrient tolerance, protein is 1.2 g/kg which is appropriate on initiation but may need to be adjusted depending on Poppy's clinical status. Poppy would be receiving 0.86 g/kg of lipid, and 2.8 mg/kg/min of dextrose which is within the guidelines for macronutrient tolerance. In this case, the formula remains appropriate for Poppy.

#### **Macronutrient distribution**

- Protein =  $304 \text{ kcal} \div 1700 \text{ kcal} \times 100 = 18\%$
- Carbohydrate =  $859 \text{ kcal} \div 1700 \text{ kcal} \times 100 = 51\%$
- Fat =  $537 \text{ kcal} \div 1700 \text{ kcal} \times 100 = 32\%$

The macronutrient distribution of Poppy's PN solution is 18% protein, 51% carbohydrate, and 32% fat — all are within the recommended ranges. The amount of protein Poppy will be receiving is on the lower end of the range and the amount of fat she will be receiving is on the higher end of the range. This is acceptable as a limited number of PN solutions are available on our formulary and we are working to meet Poppy's estimated protein requirements and limit total fluid volume. As fat is calorically dense we elected to increase her proportion of fat intake to reduce fluid intake. As with any nutrition care plan, Poppy's estimated nutrition requirements will be re-evaluated periodically based on her clinical status and her PN solution may change.

### Rate of Administration

- 5% amino acid + 16.6% dextrose:  $1.52 \text{ L} = 1520 \text{ mL} \div 24 \text{ hrs} = 63 \text{ mL/hour}$
- 20% lipid:  $269 \text{ mL} \div 24 \text{ hours} = 11 \text{ mL/hour}$
- TFI:  $1520 + 269 \text{ mL} = 1789 \text{ mL/day}$  (28mL/kg)

The last step when planning a parenteral nutrition regime is to calculate the rate of administration. Poppy will receive her “2 in 1” solution of amino acids and dextrose (plus additives) at 63 mL/hour and lipids at 11 mL/hour. This results in 1789 mL/day of fluid, which is 28 mL/kg. The ICU intensivist has approved this fluid volume.

## Initiating PN & Refeeding Syndrome

When your patient is at risk of refeeding syndrome, you should:

- Initiate feeding as soon as possible
- Determine caloric and protein requirements using current weight
- Start nutrition slowly via **continuous infusion**
- **Energy:** no more than 50% of energy requirements in the first 24 hours, maximum 15–20 kcal/kg (if at severe risk:  $\leq 10$  kcal/kg).
- **Carbohydrate:**  $< 150 \text{ g/day}$  or  $< 2 \text{ mg/kg/minute}$ . Consider all sources of carbohydrates (dextrose containing IV fluids, oral intake, medications).
- **Protein:** start at the goal of requirements up to 1.5 g/kg.
- **Supplementation:** daily multivitamin and 100 mg thiamine  $\times 3$

days.

- **Obtain bloodwork:** replace low electrolyte levels (prior to initiating feeding, 4–6 hours after initiating feeding, and daily for minimum 5 days).

## Poppy's Parenteral Regime: Refeeding Syndrome

As per our assessment, Poppy is at low-moderate risk of refeeding syndrome.

Despite the refeeding risk, PN is initiated conservatively to assess metabolic tolerance. The conservative start typically meets the requirements for safely starting nutrition support when a patient is at risk of refeeding syndrome.

Request thiamine and multivitamin supplementation for patients who are at risk.

# Summary of Nutrition Plan

## Summary of Poppy's Nutrition Care Plan

**Summary of recommendations for Poppy's nutrition care plan**

Area of Concern	Recommendations
Parenteral Nutrition	<ul style="list-style-type: none"> <li>• 5% amino acid + 16.6% dextrose: 1.52 L = 63 mL/hour x 24 hours (PRO 18%, CHO 51%)</li> <li>• 20% lipid: 269 mL= 11 mL/hour x 24 hours (FAT 32%)</li> <li>• TFI: 1520 + 269 mL = 1789 mL/day (28 mL/kg)- volume approved by MD</li> <li>• Initiate slowly at ~ 50% of poppy's requirements</li> <li>• Monitor closely for refeeding and PN complications – see implementation section</li> </ul>
Medications and Infusions	<ul style="list-style-type: none"> <li>• NS @ 10 mL/hour = 240 mL/day</li> <li>• Ongoing diuresis (furosemide): monitor fluid balance and urine output for fluid overload; adjust nutrition care plan if indicated</li> </ul>
Laboratory Values	<ul style="list-style-type: none"> <li>• Monitor electrolytes and hemodynamic stability daily</li> <li>• Sodium slightly low (132) – monitor</li> </ul>
Supplements	<ul style="list-style-type: none"> <li>• Add a daily multivitamin for risk of refeeding syndrome</li> <li>• Add 100 mg thiamine x 3 days when initiating PN due to risk of refeeding syndrome</li> </ul>
Diet	<ul style="list-style-type: none"> <li>• NPO – re: doctors orders and intolerance to EN</li> </ul>

## Simulation Activity: Poppy



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=152#h5p-64>

PART 2: PLAN COMPLETE. Pause to reflect on the nutrition care plan we created for Poppy. When you're ready, move on to Part 3: Implementation.

# Implement



## Interdisciplinary Team

There are many healthcare professionals involved in the interdisciplinary team. Depending on the patients medical plan and condition, there may be other team members involved. However, the list below represents a usual inpatient team. Their roles are discussed as it pertains to enteral nutrition.

- **Registered Dietitian:** primarily responsible for enteral nutrition, transition to oral diet.
- **Speech Language Pathologist (SLP):** assess safety of oral diet & texture recommendation.
- **Pharmacist (RPh):** drug and nutrient interactions, medication dosing/ indications.
- **Registered Nurse (RN):** implement nutrition care plan, provide clinical information.
- **Physiotherapist (PT):** ambulation, positioning, assist with obtaining weights.
- **Occupational therapist (OT):** cognitive assessment to determine if patient can provide accurate information, modified eating equipment, positioning.
- **Medical Doctor (MD) or Nurse Practitioner (NP):** medical update, enter orders for IVF, labs, imaging, medications, consults.
- **Social Worker (SW):** provide counselling, disposition planning

and identify sources of emotional support for patients and their families.

Depending on your institution, you may have a dedicated PN team. PN is a complex form of nutritional care which involves multiple disciplines: RD, MD, NP, RN, RPh, and pharmacy technicians. A multidisciplinary approach is more cost-effective, efficient and may be associated with a reduction in infectious complications and more appropriate use of parenteral nutrition (communication, training, and consensual approach).

Dedicated PN team members include:

- **Dietitian:** performs nutritional assessment to determine estimated nutrition requirements; chooses formula, quantity, rate and concentrations; monitors clinical/metabolic response; manages transition to EN/oral intake; monitors and manages some side effects, liaises with all team members.
- **Doctor or Nurse Practitioner:** oversees/consults on medical management of the patient, may insert vascular access device, responsible for signing off all nutrition prescriptions including additives.
- **Nurse:** oversees care of the vascular access site, physical management of the parenteral nutrition infusion and related equipment, training for home parenteral nutrition.
- **Pharmacist:** oversees/consults on the choice of formulation and additives, may be involved with nutrition prescription and compounding of solutions and/or loading of parenteral additives.

## Implementing Parenteral Nutrition

When monitoring for refeeding syndrome or when generally initiating PN in a critically ill patient, it is important to take a “step-

wise” approach. Conservative initiation allows you to monitor, replace, and adjust the PN as required.

Protocols vary by institution & unit (ICU vs. ward):

1. **Monitor for refeeding syndrome**
2. **On day 1, feed ≤50%** of energy requirements and follow with monitoring and replacing
3. **On day 3, feed ~75%** of energy requirements and follow with monitoring and replacing
4. **On day 4/5, feed 100%** of energy requirements and follow with monitoring and replacing
5. **Long-term PN:** Continue to revise energy and protein goals, cycle PN, monitoring and replacing

## Monitoring Parenteral Nutrition

Patients who are receiving PN require monitoring to ensure safe deliver of their nutrition care plan. Frequency of monitoring depends on your patient’s clinical condition, past medical history and tolerance of PN regime.

During implementation of the PN feeding plan, consider monitoring the following.

- **Bloodwork:** Typically monitored more frequently (daily) when starting PN and less frequently (1-2 times per week) when stable on PN. Typical labs that are ordered and monitored include: electrolytes, renal profile, calcium profile, LFTs, amylase, blood glucose, CBC, lactate, triglycerides (TG).
- **Weight:** Patients receiving PN should be weighed prior to initiation and then weekly (or bi-weekly) while receiving PN to monitor weight changes.
- **Daily intake and output:** to assess your patient’s fluid balance and actual volume of PN received.

Continuously reassess your patient's need for PN and nutrition provision based on their clinical course.

The tables below represent the monitoring parameters mentioned above.

**Anthropometric parameters, by monitoring frequency**  
 [\*] denotes: daily until stable, then once or twice weekly

	Initial	Daily	Weekly
Weight	X	X	X
Height	X		
Clinical			
Intake & Output	X	X*	

**Metabolic assessment parameters, by monitoring frequency**  
 [\*] denotes: daily until stable, then once or twice weekly  
 [\*\*] denotes: not routinely ordered  
 [\*\*\*] denotes: Initially and before each advancement of IV fat emulsions (IVFE), then once weekly. If septic, more frequent monitoring is required.

	Initial	Daily	Weekly
Na, K, Cl, CO <sub>2</sub>	X	X*	X
Ca, Phos, Mg	X	X*	X
Glucose	X	X*	X
BUN/Cr	X	X*	X
Liver Function Tests	X		X
Prothrombin time	X		X
Transferrin or Prealbumin**	X		X
Triglycerides	X***		X
Complete Blood Count	X		X

# Monitoring for Refeeding Syndrome

Below is important information to know for patients who are at risk of refeeding syndrome. Having awareness of what symptoms to watch for, knowing when symptoms occur, and what to do can allow you to optimize your patient's nutritional status as safely as possible.

- Symptoms of refeeding syndrome most often occur within 1-3 days after initiating feeding, but may occur up to 5 days following initiation of feeding.
- Closely monitor your patient's heart rate and fluid intake/output for changes that happen with initiation of feeding.
- Hypophosphatemia is a classic first sign associated with refeeding syndrome.
- Monitor electrolytes daily (K, PO<sub>4</sub>, Mg) for a minimum of 3 days. If your patient is at high risk of refeeding syndrome or shows signs of refeeding syndrome, monitor electrolytes for up to 1 week. Correct abnormalities concurrently with feeding and prior to advancing feeds.
- Advance feeding as soon as is safely possible to avoid hypocaloric feeding for prolonged period (advancement of 200-300 kcal every 1-3 days recommended)

## Parenteral Complications

### Macronutrient Complications

PN complications are often multifactorial. It is important to discuss these complications with your medical team to determine the most

likely cause and establish an appropriate treatment plan. Below is a chart of possible complications associated with parenteral nutrition.

**Causes and treatment for macronutrient-related problems associated with PN**

<b>Problem</b>	<b>Possible Causes</b>	<b>Treatment</b>
<b>EFA Deficiency</b>	<ul style="list-style-type: none"> <li>Inadequate provision of EFA</li> </ul>	<ul style="list-style-type: none"> <li>Prevention: 1-2% energy from linoleic, 0.5% energy from linoleic</li> <li>Treatment: 250 mL 20% IVFE twice weekly</li> </ul>
<b>Hypertriglyceridemia</b>	<ul style="list-style-type: none"> <li>Dextrose overfeeding</li> <li>Rapid administration of IVFE</li> <li>Propofol administration</li> </ul>	<ul style="list-style-type: none"> <li>IVFE &lt; 30% total kcal or &lt; 1g/lipid/kg/day</li> </ul>
<b>Azotemia</b>	<ul style="list-style-type: none"> <li>Excessive protein</li> <li>Dehydration</li> </ul>	<ul style="list-style-type: none"> <li>Reassess macronutrient requirements and provision</li> <li>Additional fluid if indicated</li> </ul>
<b>Hyperglycemia</b>	<ul style="list-style-type: none"> <li>Medical issues (diabetes, sepsis, catabolism, trauma, etc)</li> <li>Insulin resistance</li> <li>Refeeding</li> <li>Glucocorticoids</li> <li>Excess carbohydrates (CHO)</li> </ul>	<ul style="list-style-type: none"> <li>Correct blood glucose (BG) as per protocol</li> <li>Adjust CHO intake</li> </ul>

## Dextrose Complications

Patients may experience side effects related to continuous dextrose administration.

Some patients who receive PN may have hyperglycemia-elevated blood glucose. This hyperglycemia may or may not be related to diabetes. In critical illness, levels of stress hormones are elevated, which can cause hyperglycemia.

It is very important to achieve adequate glycemic control in patients who are acutely or critically ill as prolonged hyperglycemia may cause higher infection rates or delay wound healing. Most institutions administer insulin to patients separately, although insulin could be added to the parenteral solution. Frequently, an insulin nomogram (i.e. Humulin R) is the preferred method to optimize glycemic control.

Another complication related to increased CHO intake (or if total energy intake is too high) is increased CO<sub>2</sub> production. Patients with compromised lung function may not be able to handle high CO<sub>2</sub> production.

Occasionally with dextrose infusions we see lipogenesis (elevated triglyceride levels).

## Liver Complications

In patients who are receiving PN, we may see serum increases in various serum liver function tests. Increases in these values may indicate early signs of PN related liver disease.

If patients develop PN related liver disease there are several strategies to avoid its progression. Clinicians may:

- cycle PN delivery over a shorter period daily (i.e. 12hrs)
- decrease total energy intake to avoid overfeeding
- consider the use of Omega-3 or mixed lipids (i.e. SMOF)

Common blood tests include:

- Bilirubin
- AST (aspartate aminotransferase)
- ALT (alanine transaminase)
- GGT (gamma-glutamyl transpeptidase)

## Hepatobiliary Complications

Patients may develop hepatobiliary complications (i.e. related to liver disease) that may be associated with parenteral nutrition. Hepatobiliary complications such as steatosis, cholestasis, and gallbladder stasis share similar management strategies:

- **Rule out non-PN factors:** hepatotoxic medications, herbal supplements, biliary obstruction, hepatitis, sepsis
- **Consider PN modifications:**
  - Decrease dextrose
  - Decrease **IVFE** (< 1 g/kg/day)
  - Balance dextrose and IVFE
  - Cyclic PN infusion
  - Maximize enteral intake (oral diet or tube feeding) where appropriate
  - Prevent/treat bacterial overgrowth
- **Pharmacotherapy**

## Catheter or Blood Vessel Complications

Here is an overview of the potential catheter or blood vessel related complications of PN.

- **Blocked intravenous line:** insufficient flushing, thrombosis, line is incorrectly positioned, precipitated lipid or medication.
- **Line infection:** contamination of the line, prolonged use of the access device, contaminated parenteral nutrition solution, poor hand hygiene, not using sterile equipment, improper line care.
- **Phlebitis:** leaving catheter in too long, using a catheter too large for the vein, irritation from medications, infusing a high concentration solution.
- **Thrombosis**
- **Line displacement:** inappropriate site selection, accidental pulling of the device.

## Metabolic Complications

There are various metabolic complications that are possible when feeding patients parenteral nutrition. Please review each item in the list below to familiarize yourself with the complication. The “Troubleshooting” section of the [Dietitians of Australia’s Guide to Parenteral Nutrition \(PDF\)](#) will provide details on common interventions or solutions to these complications.

- Hyperglycemia
- Hyponatremia/ Hyponatremia
- Hyperkalemia/ Hypokalemia
- Hypercalcaemia/ Hypocalcaemia
- Hyperphosphatemia/ Hypophosphatemia
- Increased serum triglycerides
- Elevated liver function tests
- High BUN and creatinine

## Long-Term PN Complications

PN-related bone disease is a long-term complication seen in some home PN patients. The etiology is unclear, however it may be related to inadequate or excess Vitamin D intake or increased urinary calcium loss. Many long term PN patients are also on steroids (i.e. for bowel disease). Ultimately these patients can develop osteomalacia or osteoporosis.

## Education

### Poppy's Education

Poppy is asking to speak to the dietitian to understand why she is not allowed to eat. She complains of being hungry. The dietitian will need to use easy to understand language to describe the indications for PN and how PN is administered. The dietitian should explain possible side effects and complications, but also be able to reassure Poppy with evidence that this is the best treatment plan.

1. Think about the possible side effects and complications with PN.
2. List 3 benefits of PN that you could share with

Poppy.

3. Create a plain-language explanation of PN to share with Poppy.

Pause and answer these questions using the information provided to you so far.



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=154#h5p-67>

## Implementation Summary

### Implementing Poppy's Nutrition Care Plan: Summary

**Initiation of Parenteral Nutrition:** Start at 50% of requirements on day 1. If tolerated, plan to increase to 75%

on day 3. If tolerated, plan to increase to 100% on day 4 or 5. Add in multivitamin and thiamine as per nutrition care plan.

**Monitoring:** electrolytes renal profile, calcium profile, LFTs, amylase, blood glucose, CBC, lactate, and TG. Specifically monitor K, PO<sub>4</sub>, Mg for risk of refeeding syndrome.

**Clinical Documentation (“Ins and Outs”):**

- PN received
- Urine output
- Fluid balance (updated wt (with ongoing diuresis), re: nutrition care plan for fluid restriction)
- Symptoms (patient report) and medical complications

PART 3: IMPLEMENT COMPLETE. Now that you’ve finished the section, pause to reflect on the implementation strategies discussed. When you’re ready, move on to Part 4: Evaluation.

# Evaluate

## Evaluating the Nutrition Care Plan

After you have implemented your nutrition care plan, you need to follow-up and evaluate it to ensure that it has been effective in addressing your patient's nutrition concerns. This can help you to decide on appropriate changes to make to the nutrition care plan moving forward.

When evaluating your plan in a inpatient setting, you will need to gather updated information from the same key areas of nutrition concern that you identified in your initial assessment. This will include, but is not limited to: parenteral feeding delivery/ tolerance, daily intake and outputs, laboratory values, medications, disposition, and any changes to the medical care plan. Also consider if PN is still indicated, or if your patient could transition to EN or an oral diet.

**Questions to evaluate nutrition care plan effectiveness**

<b>Common Nutrition Issues</b>	<b>Evaluate effectiveness of NCP</b>
Parenteral Nutrition	<ul style="list-style-type: none"> <li>• Has the patient experienced any side effects or complications?</li> <li>• Are they meeting their estimated requirements with the current plan? Does it need to be reassessed?</li> <li>• Is parenteral nutrition still warranted?</li> </ul>
Daily Intake and Output	<ul style="list-style-type: none"> <li>• Fluid balance?</li> <li>• Volume of nutrition received?</li> <li>• Changes in head to toe assessment?</li> </ul>
Malnutrition	<ul style="list-style-type: none"> <li>• Has weight increased? Decreased?</li> </ul>
Electrolytes and Laboratory Work	<ul style="list-style-type: none"> <li>• Are the laboratory values normal?</li> <li>• Are further replacements/ supplements required?</li> </ul>
Medical Care Plan	<ul style="list-style-type: none"> <li>• Are there any changes to the medical care plan?</li> <li>• Changes in medications that impact the nutrition care plan?</li> <li>• Any updated laboratory work, tests, procedures or assessments?</li> <li>• Disposition planning? Does this impact your nutrition care plan?</li> </ul>

## Evaluating Poppy's Nutrition Care Plan

**Outcomes of Poppy's nutrition care plan, by issue type**

<b>Common Nutrition Issues</b>	<b>Evaluate effectiveness of NCP</b>	<b>Poppy's outcomes</b>
<b>Parenteral Nutrition</b>	<ul style="list-style-type: none"> <li>Day 3 of PN administration, no complications, increase to 75%-100% of requirements</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate nutrition plan and patients medical status for safety of increase</li> <li>Monitor closely for refeeding syndrome or complications with increase</li> </ul>
<b>Daily Input and Output</b>	<ul style="list-style-type: none"> <li>Urine output &gt; 2 L/day (IV Lasix (furosemide))</li> <li>+5 L fluid balance</li> </ul>	<ul style="list-style-type: none"> <li>Fluid overload – maintain fluid restriction in nutrition care plan</li> </ul>
<b>Malnutrition</b>	<ul style="list-style-type: none"> <li>Only two days since initiation – no need for evaluation at this time. Can re-weigh patient to confirm decrease in total fluid balance if desired.</li> </ul>	N/A

<p><b>Abnormal Electrolytes</b></p>	<ul style="list-style-type: none"> <li>• Elevated: WBC, BG, Cr, BUN</li> <li>• Low: Hgb, K, Mg</li> </ul>	<ul style="list-style-type: none"> <li>• Continue to monitor (up to 7 days)</li> <li>• Liaise with team regarding replacements, if determined as necessary</li> </ul>
<p><b>Medical Care Plan</b></p>	<ul style="list-style-type: none"> <li>• Patient reports increased abdominal pain distension</li> <li>• GI surgery team schedules OR – finds 20 cm segment of necrotic bowel in terminal ileum – 25 cm resected, primary anastomosis</li> </ul>	<ul style="list-style-type: none"> <li>• Potential for postoperative ileus – need for assessment</li> <li>• GI surgeon recommends continuing TPN for one week prior to trial of enteral feeding</li> </ul>

Poppy is on day 3 of PN administration with no complications, therefore it would be appropriate to advance her PN solution to 75%-100% of her estimated nutrition requirements. It is important that we still monitor closely for refeeding syndrome and complications that may result with this increase.

Poppy's fluid balance is +5 L, which is an improvement from +10 L and she has a urine output of >2 L per day. Although Poppy is still considered fluid overloaded, she is moving in the right direction. For now, maintain fluid restriction in the nutrition care plan as per MD orders.

Poppy's laboratory results reveal that her WBC, BG, Cr

and BUN are elevated and her Hgb, K, and Mg are low. It would be important to liaise with the team regarding replacements for low K and Mg, and continue monitoring her laboratory values as PN volumes increase.

Lastly, Poppy continued to experience ++ abdominal pain and distension. Taking the CT abdominal results into consideration, the GI surgery team schedules an OR and finds a 20 cm segment of necrotic bowel in the terminal ileum resulting in a 25 cm small bowel resection. Post operatively, the GI surgeon recommends continuing TPN for one week and then to trial enteral feeding upon evaluation of Poppy's clinical status.

## Weaning PN

There are various strategies for weaning PN. Patients may transition from PN to enteral feeding or an oral diet. The oral diet may consist of various textures and oral supplements are also taken into consideration.

Here is a general procedure for weaning PN for patients transitioning to enteral feeding:

- PN may be weaned when patient is able to tolerate oral intake/EN.
- PN should be reduced as oral intake/EN improves. PN should be reduced by an amount that is equal to the calories and protein provided via oral intake/EN.
- Calories counts can be used to assess adequacy of oral intake. Reduced oral intake can be expected if PN provides > 25% kcal requirements.

- PN may be discontinued when patient is tolerating 50-75% energy and protein requirements via oral intake/EN, unless impaired GI function precludes 100% absorption of nutrient needs.
- Some institutions do not gradually wean PN. PN is continued at goal rate and discontinued when the patient is receiving ~50% of their estimated nutrition requirements via enteral nutrition or oral intake.

Pause here and consider how you may start a trial of enteral nutrition for Poppy.

## Weaning PN for Poppy

This is what you could do to start a trial of enteral nutrition for Poppy:

- Liaise with the GI surgery MD/ICU team to ensure they agree with restarting EN.
- Re-evaluate Poppy's estimated nutrition requirements: energy, protein, fluid
- Complete a head-to-toe assessment
- If the team agrees to initiate EN, start conservatively to evaluate GI tolerance:
  - Example ("trickle feed"): Isosource 1.5 @ 10 mL/hour × 24 hours = 240 mL/day
- Ask her RN to monitor closely for signs any of GI

intolerance.

- If EN is well tolerated, decrease PN gradually as EN rate increases as described above. Review flow sheets or documented “ins and outs” in Poppy’s chart to assess PN & EN volumes received. Use this information to avoid overfeeding and continue to meet her estimated nutrition requirements, as you adjust and transition to EN.

**Considerations:** absorption of nutrients is likely to remain adequate as a small portion of poppy’s small bowel was removed (removal of 25 cm of ileum – vitamin B12 and bile salts absorbed in terminal ileum).

## The Nutrition Care Process Model

As you use the Nutrition Care Process Model and the learning from this case study as a guide throughout your patient care in practicum, please keep in mind that the process is dynamic, and not step-by-step as all cases are different. You are encouraged to complete the recommended readings for this module and continue to expand your learning in this clinical area of practice.

PART 4: EVALUATE COMPLETE. Pause to reflect on the evaluation strategies discussed, and review the

readings and resources in the following section for your information.

You've now completed the Parenteral Nutrition module. Please consider providing feedback through the embedded form in the next section.

## Acknowledgements

Emily Opperman, MSc, RD

Michaela Kucab, MHSc, RD

# Feedback Form



*One or more interactive elements has been excluded  
from this version of the text. You can view them online*

here: [https://pressbooks.library.torontomu.ca/  
dietmods/?p=2246](https://pressbooks.library.torontomu.ca/dietmods/?p=2246)

# Reading List

The following is a list of readings and resources to help supplement your learning in this module topic.

## Readings

- Bielawska B, Allard JP. [Parenteral Nutrition and Intestinal Failure](#). Nutrients. 2017 May 6;9(5):466. doi: 10.3390/nu9050466.
- Bryan D. Hayes, Sophie Gosselin, Diane P. Calello, Nicholas Nacca, Carol J. Rollins, Daniel Abourbih, Martin Morris, Andrea Nesbitt-Miller, José A. Morais, Valéry Lavergne & Lipid Emulsion Workgroup (2016) [Systematic review of clinical adverse events reported](#) after acute intravenous lipid emulsion administration, Clinical Toxicology, 54:5, 365-404, DOI: 10.3109/15563650.2016.1151528
- [ESPEN Guidelines](#) on Parenteral Nutrition:
  - [Adult Renal Failure](#)
  - [Intensive care](#)
  - [Pancreas](#)
- Madsen H., Frankel E.H. [The hitchhiker's guide to parenteral nutrition management for adult patients](#). Pract. Gastroenterol. 2006;30:46-68.

## Additional Resources

- [ASPEN Parenteral Nutrition Resources](#)

- Canadian Malnutrition Task Force – [SGA: Diagnosing Malnutrition](#)

# INPATIENT GI

Welcome to the Inpatient GI section! Throughout this section, an inpatient case study will be used to help you learn what information to gather for an assessment, how to interpret that data to form a nutrition care plan, how to implement the care plan, and what to look for when following-up and evaluating your plan. As you progress through the content, please keep in mind that the nutrition care process model is dynamic and not a linear, step-by-step process. The case study used here is an example, and not all cases will follow the same path.



[Photo by National Cancer Institute](#) on Unsplash

# Learning Objectives

By the end of the section you will be able to:

1. Understand the pathophysiology, risk factors, and procedures associated with inflammatory bowel disease and pancreatitis.
2. Identify where to gather clinical, anthropometric, biochemical, and dietary data necessary to complete a nutrition assessment for a patient living with gastrointestinal disease.
3. Identify the purposes of nutrition care for inflammatory bowel disease, management of ostomies, and pancreatitis.
4. Create a nutrition care plan for gastrointestinal disease by gathering relevant assessment data, creating a PES statement, identifying areas of concern, determining priorities for nutrition care, and identifying areas for monitoring.
5. Understand the roles of the members of the interprofessional team, including the dietitian, physician (gastroenterologist, general surgeon), nurse (registered nurse, nurse practitioner, ostomy nurse), pharmacist, social worker, occupational therapist, physiotherapist, and spiritual care.
6. Recognize the purposes of nutrition education and can identify strategies to effectively communicate and implement education.
7. Identify and understand basic nutrition education for inflammatory bowel disease, managing ostomies, and pancreatitis.
8. Evaluate the nutrition care plan using assessment data relevant to the clients nutrition concerns, progression of status, inputs and outputs, laboratory values, medications, education, and the medical care plan.

# Background

## Conditions Covered in this Section

This “Background” section of the Inpatient GI module addresses three main conditions:

1. Inflammatory Bowel Disease (IBD)
2. Ostomies
3. Pancreatitis

After reviewing background information, you will be led through the Nutrition Care Process along with a relevant case study to apply your knowledge. The case study will be a complex case focused on IBD and ostomies. A summary of evidence, education, and recommendations will be provided for all topics.

It may also be useful to review the first section of the [Background for Outpatient GI](#), which provides a general overview of GI system components, digestion, and nutrient absorption.

## Inflammatory Bowel Disease (IBD)

Inflammatory Bowel Disease (IBD) is a term referring to two inflammatory conditions of the digestive tract. Crohn’s disease and ulcerative colitis are the two main forms of IBD. Their similarities and differences will be explored in this section. Although the specific cause of IBD remains unknown, the main hypothesis relates to immune system malfunction and heredity factors.

**Symptoms** may include severe diarrhea (with blood and mucus), abdominal pain, fatigue, malabsorption of nutrients, anemia, and weight loss. As a result, IBD disrupts the body's ability to digest food, absorb nutrients and eliminate waste. It is estimated that up to 85% of hospitalized IBD patients have protein energy malnutrition, based on abnormal anthropometric and biochemical parameters.

Although specific causes of IBD are yet to be discovered, there are **risk factors** associated with IBD:

- **Age:** Most people who develop IBD are diagnosed before they're 30 years old. Some people don't develop the disease until their 50s or 60s.
- **Ethnicity:** Caucasian's have the highest risk of the disease; but it can occur in any race.
- **Family history:** You're at higher risk if you have a close relative, such as a parent, sibling or child with the disease.
- **Cigarette smoking:** Cigarette smoking is the most important controllable risk factor for developing Crohn's disease. Although smoking may provide some protection against ulcerative colitis, the overall health benefits of not smoking make it important to try to quit.
- **Non-Steroidal anti-inflammatory medications (NSAIDs):** These include ibuprofen (Advil, Motrin), naproxen sodium (Aleve), diclofenac sodium (Voltaren) and others. These medications may increase the risk of developing IBD or worsen disease in people who have IBD.
- **Where you live:** If you live in an industrialized country, you're more likely to develop IBD. Therefore, it may be that environmental factors, including a diet high in fat or refined foods, play a role. People living in northern climates also seem to be at greater risk.

Some of these are modifiable risk factors (such as cigarette

smoking), while other factors are fixed (such as family history and ethnicity). It is important to note that diet and stress do not *cause* IBD, but still play a role in aggravating symptoms for those diagnosed.

## Comparing Crohn's Disease and Ulcerative Colitis

**Crohn's Disease** is a chronic inflammatory disease that may involve any area throughout the entire digestive tract – anywhere from the mouth to the anus. However, it often affects the terminal ileum within the small intestine. Inflammation can extend through the entire thickness of the bowel wall, resulting in diarrhea, strictures, anal fissures, abscesses and fistulas.

**Ulcerative Colitis** is an inflammatory disease that begins at the anus and involves the inner mucosa of the colon. The inflammation does not result in fistulas, although extensive inflammation may require surgery to remove affected area. Ulcerative proctitis, a milder form of UC, occurs at a maximum of 20 cm proximal to the anus.

### Complications in common

Ulcerative colitis and Crohn's disease have some complications in common and others that are specific to each condition.

Complications found in both conditions may include:

- **Colon cancer:**having IBD increases your risk of colon cancer. General colon cancer screening guidelines for people without IBD call for a colonoscopy every 10 years beginning at age 50. For those with IBD, this test may need to be done sooner and

more frequently.

- **Skin, eye and joint inflammation:** Certain disorders, including arthritis, skin lesions and eye inflammation (uveitis), may occur during IBD flare-ups.
- **Medication side effects:** Certain medications for IBD are associated with a small risk of developing certain cancers. Corticosteroids can be associated with a risk of osteoporosis, high blood pressure and other conditions.
- **Primary sclerosing cholangitis:** In this condition, inflammation causes scars within the bile ducts, eventually making them narrow and gradually causing liver damage.
- **Blood clots:** IBD increases the risk of blood clots in veins and arteries.

## Complications of Crohn's Disease

The complications specific to Crohn's disease are related to the deeply-penetrating nature of the inflammation, as well as its ability to affect any spot along the digestive tract. The severity and recurrence of complications is variable.

- **Bowel obstruction:** Crohn's disease affects the full thickness of the intestinal wall. Over time, parts of the bowel can thicken and narrow, which may block the flow of digestive contents. Patient's may require surgery to remove the diseased portion of the bowel.
- **Malnutrition:** Diarrhea, abdominal pain and cramping may make it difficult to eat or for the intestine to absorb enough nutrients to keep the patient nourished. It's also common to

develop anemia due to low iron or vitamin B12 caused by the disease.

- **Ulcers:**Chronic inflammation can lead to open sores (ulcers) anywhere in the digestive tract, including the mouth and anus, and in the genital area (perineum).
- **Fistulas:**Sometimes ulcers can extend completely through the intestinal wall, creating a fistula – an abnormal connection between different body parts. Fistulas near or around the anal area (perianal) are the most common kind. In some cases, a fistula may become infected and form an abscess.
- **Anal fissure:**This is a small tear in the tissue that lines the anus or in the skin around the anus where infections can occur. It's often associated with painful bowel movements and may lead to a perianal fistula.



Two ulcers on the labial mucosa of the upper lip. Photo by [Universidad de La Frontera](#) , CC BY-NC 4.0

# Complications of Ulcerative Colitis

Ulcerative Colitis may appear to have fewer complications than Crohn's, but it is important to remember that the inflammation may still require surgery, ultimately affecting nutrient absorption and increasing malnutrition risk. These complications can be life-threatening if not addressed.

- **Toxic megacolon:**Ulcerative colitis may cause the colon to rapidly widen and swell, a serious condition known as toxic megacolon.
- **Severe dehydration:**Excessive diarrhea can result in dehydration

## Factors Altering Nutritional Status

There are many factors that can impact an individual's nutrition status in IBD. They may increase someone's risk of malnutrition, affect their ability to access or prepare food, and change their anthropometric data.

Review the following factors and identify which are more closely related to Crohn's, Ulcerative Colitis, or both.

- Decreased nutrient intake
- Severe diarrhea
- Blood in stool
- Abdominal pain and cramping
- Fatigue
- Weight loss
- Nausea and vomiting
- Restrictive diets
- Side effects of medications (appetite suppression, taste alterations)

- Mouth sores
- Increased needs for healing (protein, vitamins and minerals)
- Malabsorption
- Surgical resections

## Treatment Options

Treatment for IBD falls into two main categories: medications and surgery. Drugs are primarily used to manage symptoms of IBD and reduce inflammation, the most common of which are explored in the “Medications” section below. Crohn’s disease is more likely to require surgical treatment, with around 70% of individuals affected undergoing ileostomy or bowel resection. The complications of each GI surgery are listed in the “Surgery” section below.

### Medications

The tables below provide an overview of medications used to reduce inflammation and manage symptoms of patients with IBD.

**Medications used for reducing inflammation in patients with IBD**

Medications	General Explanation	Examples
<b>Sulfasalazine and 5-Aminosalicylates (5-ASA)</b>	These drugs limit the production of certain chemicals that trigger inflammation. This medicine is generally prescribed to help combat <b>milder attacks</b> of Crohn's or UC.	Mesalamines, Sulfazine
<b>Steroids</b>	Steroids aim to reduce inflammation. These drugs are used by patients who have <b>moderate to severe</b> attacks.	Prednisone, Hydrocortisone
<b>Immunomodulators</b>	This type of medicine alters how the body mounts an inflammatory response. Immunomodulators do suppress the ability to fight infections in general. These drugs are used by patients who have <b>moderate to severe</b> attacks.	Methotrexate
<b>Biologics</b>	These drugs target and block molecules involved in inflammation. These drugs are used to combat <b>moderate to severe</b> attacks.	Adalimumab (Humira) Infliximab (Remicase, Inflectra) Vedolizumab (Entyvio) Ustekinumab (Sterlara)
<b>Antibiotics</b>	Antibiotics do not counteract inflammation directly but decrease infection that can cause severe inflammation.	Ciprofloxacin, Metronidazole

### Medications used for managing symptoms in patients with IBD

Medications	General Explanation	Examples
<b>Antidiarrheals</b>	Used to treat diarrhea and works by slowing down the movement of the gut. Relieves symptoms of increased frequency and urgency.	Loperamide, Diphenoxylate, Cholestyramine
<b>Antispasmodics</b>	Relieves, prevents or lowers the incidence of muscle spasms.	Hyoscyamine, Dicyclomine
<b>Bulk formers</b>	Soak up water in the stool, thereby firming it up as well as reducing frequency.	Fybogel, Normacol
<b>Bile salt binders</b>	Prevent irritation of the gut by capturing bile salts.	Cholestyramine, Colestipol
<b>Stool softeners</b>	For softening feces to ease bowel movements.	Docusate
<b>Analgesics</b>	For pain reduction	Acetaminophen, Morphine, Hydrocodone, Oxycodone
<b>Non-steroidal anti-inflammatory drugs (NSAIDs)</b>	For pain control in joints (Note: some people find these drugs aggravate their abdominal pain and diarrhea).	Aspirin, Ibuprofen, Naproxen
<b>Acid reducing drugs</b>	For "heartburn"	Cimetidine, Famotidine, Nizatidine

## Surgery

Approximately 70% of people with Crohn's and 40% of those with Ulcerative Colitis will require surgery at some point in their lives. Surgery should not be regarded as a last resort, it is simply another treatment option. The most common types of surgeries for people with IBS are ileostomies or primary resection.



*An ileostomy bag is placed over the stoma to collect waste matter. Photo by [Remedios44](#), [CC BY-SA 4.0](#), via Wikimedia Commons*

The table below summarizes nutrition complications after GI surgery, depending on the type of resection.

Nutrition complications after GI surgery, by type of resection

Type of Resection	↑ TG	↑ BG	Fluid/ electrolyte balance	GI Function			
				Gastroparesis	Anastomotic Leak	Chyle Leak	Dum Synd
Esophagastric			X		X	X	X
Gastric	X			X			X
Pancreas	X		X	X	X	X	X
Hepatocellular	X	X	X			X	
Gall Bladder	X		X	X		X	
Bile Duct	X		X			X	
Small Bowel	X		X	X		X	
Colon or Rectum			X			X	

## Ostomies

An **ostomy** is a change in the way urine or stool exits the body as a result of a surgical procedure. Bodily waste is rerouted from its usual path because of malfunctioning parts of the urinary or digestive system. An ostomy can be temporary or permanent.

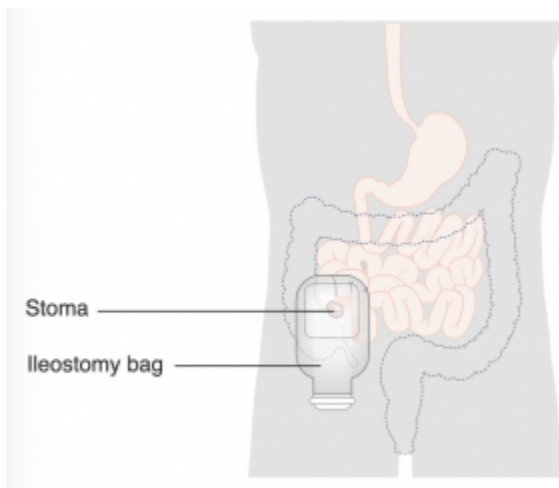
A **stoma** is the opening created by the ostomy surgery. It is located on the abdomen and is dark pink in color. For most ostomies, a pouch is worn over the stoma to collect stool or urine. For some people it is possible to have a continent diversion, an alternative to a conventional ostomy that eliminates the necessity for a pouch.

The three most common forms of ostomies are ileostomies, colostomies, and urostomies.

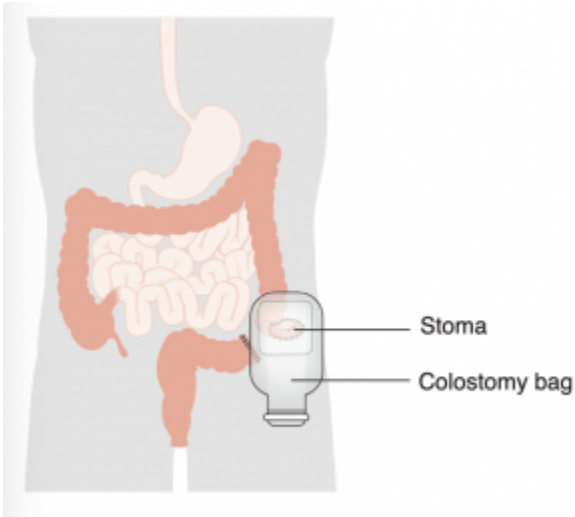
**Ileostomy:** A surgically created opening from the ileum, the lowest part of the small intestine. The intestine is brought through the abdominal wall to form a stoma. Ileostomies may be temporary or permanent, and may involve removal of all or part of the colon.

**Colostomy:** The surgically created opening of the colon (large intestine) which results in a stoma. A colostomy is created when a portion of the colon or the rectum is removed, and the remaining colon is brought to the abdominal wall. It may further be defined by the portion of the colon involved and/or its permanence.

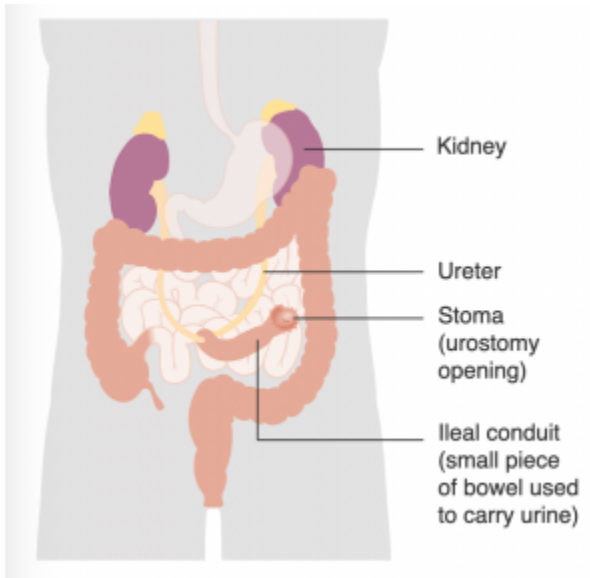
**Urostomy:** This is a general term for a surgical procedure which diverts urine away from a diseased or defective bladder. The ileal or cecal conduit procedures are the most common urostomies. Either a section at the end of the small bowel (ileum) or at the beginning of the large intestine (cecum) is surgically removed and relocated as a passageway for urine to pass from the kidneys to the outside of the body through a stoma.



Placement of an ileostomy bag. Photo by [Cancer Research UK](#), [CC BY-SA 4.0](#), via Wikimedia Commons



Placement of a colostomy bag. Photo by [Cancer Research UK](#), [CC BY-SA 4.0](#), via Wikimedia Commons



The creation of a urostomy by way of an ileal conduit. [Cancer Research UK, CC BY-SA 4.0](#), via Wikimedia Commons

## Pancreatitis

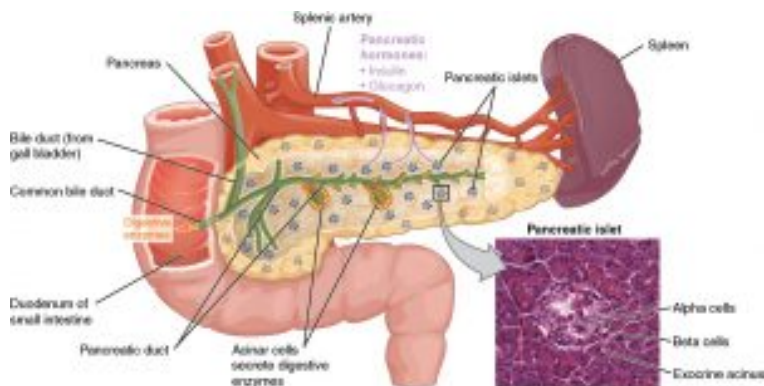
The pancreas is an important gland in the digestive system, located behind the stomach in the upper abdomen.

There are two **main functions of the pancreas**:

1. **Exocrine**, which makes digestive enzymes
  - Enzymes such as amylase, lipase and gastric juices help to digest food
  - The pancreas releases enzymes into progressively larger ducts towards the main pancreatic duct
  - The enzymes then drain into the duodenum

## 2. **Endocrine**, which makes hormones

- The Islets of Langerhans make insulin and glucagon
- These hormones are released into the blood stream to control blood sugar (glucose) levels



An overview of the functions of the pancreas. Diagram by [OpenStax College](#), [CC BY 3.0](#), via [Wikimedia Commons](#)

**Pancreatitis** is inflammation in the pancreas. Pancreatitis occurs when digestive enzymes become activated while still in the pancreas, irritating the cells of your pancreas and causing inflammation. With repeated bouts of acute pancreatitis, damage to the pancreas can occur and lead to chronic pancreatitis. Mild cases of pancreatitis may go away without treatment, but severe cases can cause life-threatening complications. Risk factors include excessive alcohol consumption, cigarette smoking, obesity and family history.

Pancreatitis can occur as **acute pancreatitis**, meaning it appears suddenly and lasts for days; or as **chronic pancreatitis**, which occurs over many years.

# Acute Pancreatitis

**Signs and symptoms** of acute pancreatitis include upper abdominal pain, fever, rapid pulse, nausea, and vomiting.

Many causes of acute pancreatitis exist, with biliary stones and alcohol overuse causing around 70–80% of cases. Obstructive causes like gallstones and tumours may also occur. Gallstones can get stuck in the common bile duct and press on the pancreatic duct, which blocks normal flow and leads to pancreatic injury. Other causes can include: toxins such as scorpion bites, certain drugs (ex. azathioprine), trauma from surgical procedures or blunt trauma, and infections (viruses, bacteria, parasites). Metabolic causes for acute pancreatitis include hypertriglyceridemia and hypercalcemia. There are several **classifications** of acute pancreatitis that are defined differently:

- **Mild** acute pancreatitis: No organ failure, local or systemic complications
- **Moderately severe** acute pancreatitis: Transient organ failure > 48 hours, local complications
- **Severe** acute pancreatitis: Persistent organ failure > 48 hours, local complications
  - **Necrotizing** acute pancreatitis: Inflammation associated with necrosis (death) of the pancreas or surrounding tissues (increased risk of death by 36–50%)

Initial **treatment** in the hospital for acute pancreatitis involves various management strategies.

**Fasting** is indicated to allow the pancreas to recover. Once the inflammation in the pancreas is controlled, the patient will typically be switched to clear fluids and eating bland foods. With time, they can go back to a normal diet.

As pancreatitis can cause severe pain, **pain medications** are often used. The health care team will give the patient medications to

help control the pain. Dehydration is also likely. For this reason, individuals typically receive extra **fluids through intravenous route (IV)**.

**Treatment of the underlying cause** will range based on the patient's circumstances and needs. This could include surgery, medications, or education (dietary, alcohol dependence, etc).

## Chronic Pancreatitis

Chronic pancreatitis is an inflammation of the pancreas that doesn't improve over time. There are numerous causes of chronic pancreatitis. The most common cause is long-term alcohol abuse. Approximately 70% of cases are linked to alcohol consumption. Chronic pancreatitis is associated with unique **complications** relevant to nutrition, some of which may be more common than others.

**Nutrient malabsorption** is one of the most common complications, related to pancreatic digestive enzymes. Specifically, vitamin B12 deficiency and fat-soluble vitamin deficiency can occur. The development of **diabetes** is also common, as pancreatitis damages the cells that produce insulin and glucagon. About 45% of people with chronic pancreatitis will develop diabetes.

**Pseudocysts** are another complication of chronic pancreatitis. These "cysts" are a collection of pancreatic fluid caused by direct leakage from the inflamed gland or the pancreatic duct. About 50% of pseudocysts resolve on their own. Treatment may be necessary when they become symptomatic, infected, or are increasing in size.

**Treatments** of chronic pancreatitis may have similarities to that of acute pancreatitis, such as with **pain medications**, and dietary **education**. Unique treatment approaches are also used, such as **enzymes to improve digestion**. Pancreatic enzyme supplements help the body break down and absorb the nutrients in

food, and are taken with each meal. If the patient has autoimmune pancreatitis, **steroids** may be used. **Surgery** is not necessary for most people, but remains an option.

Background complete! Feel free to review any resources and move to the next section “Assess” when you are ready.

# Assess



## Gathering Data for an Assessment

Gather the following information for your assessment:

1. **Clinical Data:** History of presenting illness (HPI), investigations, pathology, scheduled procedures, consultations, medical orders (medications, infusions), clinical documentation (fluids in and out, bowel movements, drains and tubes, vitals, and documentation of symptoms), medical plan, disposition plan.
2. **Anthropometric Data:** Weight, height, BMI, % weight change, % usual body weight, physical assessment, subjective global assessment.
3. **Nutritional Requirements:** energy, protein, and fluid.
4. **Biochemical Data:** Laboratory values.
5. **Dietary Data:** Estimation of caloric/protein/ fluid requirements, hospital diet order, dietary restrictions, allergies, eating behaviour and patterns, 24 hour recall, calorie counts, supplements, previous nutrition interventions.

Before asking the patient questions for your assessment, make sure to introduce yourself and set the agenda for the discussion.

# Subjective Global Assessment

According to the Canadian Malnutrition Task Force:

Subjective global assessment (SGA) is the gold standard for diagnosing malnutrition. SGA is a simple bedside method used to diagnose malnutrition and identify those who would benefit from nutrition care. The assessment includes taking a history of recent intake, weight change, gastrointestinal symptoms and a clinical evaluation.

You can refer to the [SGA Form \(PDF, 2017\)](#) from Dr. Jeejeebhoy and the [Canadian Malnutrition Task Force](#) for further practice.

Watch the video below (6:36) from UC San Diego Health. It demonstrates a nutrition-focused physical exam for identifying malnutrition. Note: captions were not uploaded for this external video, but you can read a [read a transcript for the video \(PDF\)](#) instead.



One or more interactive elements has been excluded from this version of the text. You can view them online

here: <https://pressbooks.library.torontomu.ca/dietmods/?p=162#oembed-1>

## Case Study: Meet Sam



*Your patient, Sam Stevenson*

You are a Registered Dietitian (RD) in the Gastroenterology unit of a hospital. The patient you are assessing is a 42 year old male named Sam Stevenson. You have been following this patient but your assessment (for the purposes of the case study) is on day 2 post-operation/hospital admission.

## Clinical Data

Clinical data can include, but is not limited to:

- **Reason for visit:** hospital visit or RD assessment.
- **Past medical history** (PMHx): health history to date.
- **History and presenting illness** (HPI): symptoms, surgeries, prognosis, tests (i.e. CT scan, ultrasound)
- **Current medical orders:** IV infusions, medications (IV or oral), relevant consultations (i.e. RD, Speech Language Pathologist (SLP), Physiotherapist (PT), Gastroenterologist, etc.).
- **Clinical documentation:** Fluids intake (i.e. oral, IV, TPN/EN) and output (i.e. urine, vomit, bowel movements, drains (i.e. catheter, chest tube, surgical site drain) and suctioning (i.e. oral secretions, OGT to straight drain), documentation of tubes (i.e. G-tube vs. NGT) and lines (i.e. PICC), and vitals.
- **Medical care plan and disposition:** chemotherapy, radiation therapy, scheduled surgery, transfer to different floor, rehab facility, treatment facility, long term care, home.

## Sam's Clinical Data & Documentation

Review Sam's clinical data. Take note of components that you think may be of importance for a nutrition care plan or to consider in the context of his patient care.

- **Age:** 42-year-old male
- **HPI:** 5-year history of Crohn's disease, frequent hospital admissions for pain and diarrhea, worsening frequency of flares.
- **Admission:** 3 days ago for intense pain, diarrhea, nausea and decreased appetite – unable to work for

the past 2 weeks – poor dietary intake – has lost over 15 kg over the past two months and 3 kg over the last two weeks.

- **Pathology:** Crohn's disease.
- **Operations/ Procedures:** Investigation reveals ischemic tissue in the ileum – GI surgeon performs an ileocaecal resection removing 70 cm of the terminal ileum. Temporary ileostomy to allow the colon to rest (re: extensive inflammation).
- **Consultations:** RD consult for diet order progression and ileostomy education.
- **Medications:**
  - Prednisone (a corticosteroid): On a daily dose of 10 mg/day for the past 2 months. MD increased dose to 30 mg/day IV while in hospital.
  - Metronidazole (an antibiotic): MD prescribed 500 mg IV while in hospital (post-op)
  - Pantoprazole (a proton pump inhibitor): MD prescribed 40 mg IV while in hospital (post-op)
  - *Look up each of these medications and determine why Sam is receiving them and the potential side effects*
- **Medical plan:** Medical Doctor (MD) plans for Sam to stay in hospital for ~3-5 days post-op for monitoring (pending possible complications). Temporary ileostomy – plan to complete resection in 3 months.
- **Disposition plan:** home once stable.

Review Sam's clinical documentation. Note that your assessment is on day 2 post-op.

- **Day 0 (day of his surgery) post-op:** patient was NPO (with ice chips)
- **Day 1 post-op:** patient was ordered clear fluids.
- **Symptoms:** On day 0, nurse reports that patient was complaining of nausea and fatigue – consumed a cup of ice chips. On day 1, nurse reports that patient is feeling better, is drinking clear fluids (water, juice ~ 800 mL/day) consistently and is walking around the ward (infrequently). Patient still fatigued and weak.
- **Infusions:** MD ordered (on day 0 of post-op) IV  $\frac{2}{3}$  and  $\frac{1}{3}$  @100 mL/hour = 2400 mL/day
- **Ostomy output:** Day 0 = 200 cc; day 1 = 1200 cc; referred to as an 'active ileostomy'
- **Urine output:** Day 0 = 720 mL (~30 mL/hour); Day 1 = 1,500 mL (~60 mL/hour)

As your assessment is taking place on day 2 post-op, you would have access to 2 days worth of important clinical documentation and information to inform your next steps for the nutrition care plan.

A key component is the assessment of fluid intake and ostomy output at this stage. We need to make sure the ostomy is functioning, referred to as an active ileostomy, before progressing Sam's diet. Fluid intake is an important component of his care plan in regard to preventing dehydration and electrolyte imbalance given his recent surgery. Urine output is important in reviewing Sam's fluid balance.

# Anthropometric Data

## Assessment of Body Weight

Body weight is the most used indicator of nutritional status, as it is used for calculating fluid, protein, and energy requirements.

Important considerations to identify include:

- adjustments in weight (i.e. amputations, fluid retention)
- if this is the most appropriate weight to use for calculations (i.e. are you overfeeding or underfeeding?)
- the weight you are feeding

Obtaining height and age is often necessary to further interpret body weight. Body Mass Index (BMI) is commonly used as a classification to evaluate health risk, as demonstrated in the table below. Master's tables are used for adults aged 65+.

**Health risk classification, according to Body Mass Index (BMI)**  
**BMI = weight (in kg) divided by height (in m<sup>2</sup>)**  
*Adapted from the Sunnybrook Clinical Nutrition Resource Handbook*

Classification	BMI Category (kg/m <sup>2</sup> )	Risk of Developing Health Problems
Underweight	<18.5	Increased
Normal weight	18.5-24.9	Least
Overweight	25.0-29.9	Increased
Obese class I	30.0-34.9	High
Obese class II	35.0-39.9	Very high
Obese class III	>40.0	Extremely high

It is important to use other markers of weight, including % weight

change and % usual body weight (UBW) during your assessment to further evaluate your patient's weight. The calculations in the tables below will help you interpret the findings in regard to severity and indication of malnutrition.

**% of weight loss, by time frame and severity**  
 $\% \text{ weight loss} = (\text{usual body weight} - \text{current weight}) \times 100$   
*Adapted from the Sunnybrook Clinical Nutrition Resource Handbook*

Time Frame	Significant Weight Loss (%)	Severe Weight Loss (%)
<b>1 week</b>	1-2	> 2
<b>1 month</b>	5	> 5
<b>3 months</b>	7.5	> 7.5
<b>6 months</b>	10	> 10
<b>Unlimited time</b>	10-20	> 20

**% Usual Body Weight (UBW), with malnutrition interpretations**  
 $\% \text{ UBW} = (\text{current body weight} \div \text{usual body weight}) \times 100$   
*Adapted from the Sunnybrook Clinical Nutrition Resource Handbook*

UBW range (%)	Interpretation
85 – 95	May indicate mild malnutrition
75 – 84	May indicate moderate malnutrition
< 74	May indicate severe malnutrition

## Sam's Anthropometric Data: Body Weight

- **Height:** 6'1" (1.86 m)

- *Imperial to metric conversion:* 6'1" tall = 73.2 inches (12 inches/ft) × 2.54 cm/inch = 186 cm
- **Current weight:** 145 lbs (65.9 kg)
  - *Imperial to metric conversion:* 145 lbs ÷ 2.2 lbs/kg = 65.9 kg
- **Current BMI:** 19.1 kg/m<sup>2</sup>
  - *Calculation:* 65.9 kg ÷ 1.86 m<sup>2</sup> = 19.1 kg/m<sup>2</sup>
- **Usual weight:** 180 lbs (reported by patient)
- **Timeframe of weight loss:** 2 months
- **% weight loss:** 19.4%
  - *Calculation:* [81.8 kg – 65.9 kg] ÷ 81.8 kg) × 100 = 19.4%
- **% UBW:** 80.6%
  - *Calculation:* (65.9 kg ÷ 81.8 kg) × 100 = 80.6%



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=162#h5p-49>

## Physical Assessment

Another important assessment strategy is to physically evaluate your patient. It is important to go into your patient's room to evaluate physical signs and symptoms of malnutrition. The SGA provides guidance on how to complete a physical examination by using a head-to-toe method for the assessment of muscle wasting, subcutaneous fat, and fluid retention.

### SGA guidance for assessment of Muscle Wasting

Source: [Canadian Malnutrition Task Force SGA Form \(PDF\)](#)

[\*\*] Note: in the elderly, this may reflect aging, not malnutrition.

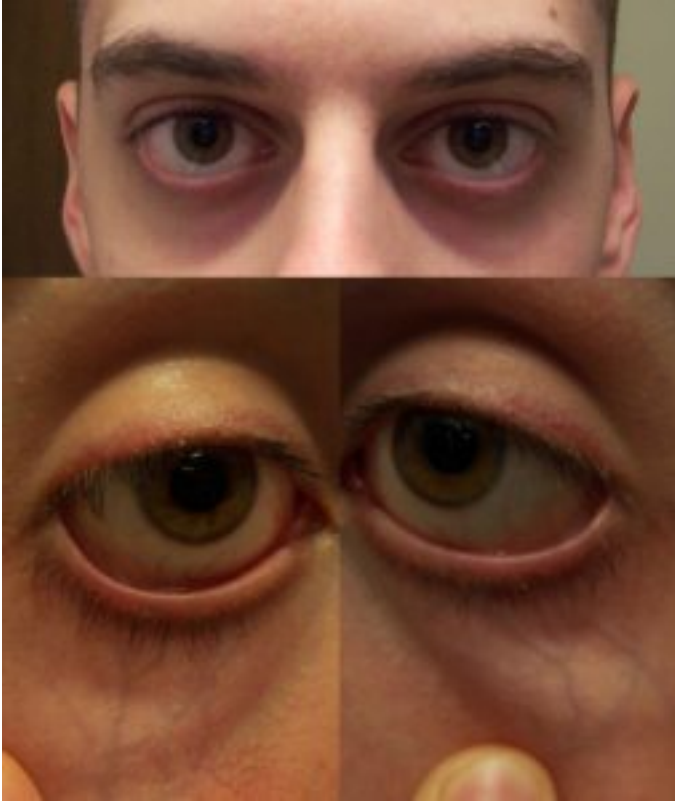
Physical Examination	Normal	Moderate	Severe
<b>Temple</b>	Well-defined muscle	Slight depression	Hollowing, depression
<b>Clavicle</b>	Not visible in males, may be visible but not prominent in females	Some protrusion; may not be all the way along	Protruding/ prominent bone
<b>Shoulder</b>	Rounded	No square look, <b>acromion process</b> may protrude slightly	Square look, bone prominent
<b>Scapula/ribs</b>	Bones not prominent	Mild depression or bone may show slightly	Bone prominent, significant depressions
<b>Quadriceps</b>	Well defined	Depression/ atrophy medially	Prominent knee, severe depression medially
<b>Interosseous muscle between thumb and forefinger (back of hand)**</b>	Muscle protrudes, could be flat in females	Slightly depressed	Flat or depressed area



The interosseous muscle is depressed in a patient with muscle wasting. [Photo by Juniper Publishers](#) is licensed under a [Creative Commons Attribution 4.0 International License](#)

**SGA guidance for assessment of Subcutaneous Fat**  
**Source: Canadian Malnutrition Task Force SGA Form**

<b>Physical Examination</b>	<b>Normal</b>	<b>Moderate</b>	<b>Severe</b>
<b>Under the eyes</b>	Slightly bulging area.	Somewhat hollow look, slightly dark circles.	Hollowed look, depression, dark circles.
<b>Triceps</b>	Large space between fingers.	Some depth to fat tissues, but not ample. Loose fitting skin.	Very little space between fingers or finger touch.
<b>Ribs, lower back, sides of trunk</b>	Chest is full, ribs do not show. Slight to no protrusion of the <b>iliac crest</b> .	Ribs obvious, but indentations are not marked. Iliac crest somewhat prominent.	Indentation between ribs obvious. Iliac crest very prominent.



Hollow, dark circles under the eyes. [Photo by Serdar G., CC0](#), via Wikimedia Commons

**SGA guidance for assessment of Fluid Retention**  
**Source: Canadian Malnutrition Task Force SGA Form**

<b>Physical Examination</b>	<b>Normal</b>	<b>Moderate</b>	<b>Severe</b>
<b>Edema</b>	None	Pitting edema of extremities / pitting to the knees, possible <b>sacral</b> edema if bedridden	Pitting beyond knees, sacral edema if bedridden, may also have generalized edema
<b>Ascites</b>	Absent	Present (may only be present on imaging)	Present (may only be present on imaging)

## Sam's Anthropometric Data: Physical Assessment

- Physical exam reveals moderate muscle wasting and moderate loss of subcutaneous fat
- Slight depression of temples and protrusion of clavicle and shoulder
- Ribs showing
- No distension in abdomen
- No edema
- Patient can ambulate, but walks infrequently due to weakness
- Temperature and respiratory rate normal

Review Sam's physical assessment data. Overall, the physical assessment using the SGA reveals moderate muscle wasting and moderate loss of subcutaneous fat.

## Nutritional Requirements

### Energy Requirements

Predictive equations are for estimation purposes only. The most accurate data will provide the most accurate estimation, but

without indirect calorimetry this is the best we can achieve. As a result, there is a need for frequent re-assessment of energy requirements.

Factors affecting the accuracy of estimated requirements include:

- Acute or chronic respiratory distress syndrome
- Large open wounds or burns
- Malnutrition with altered body composition
- Underweight, obesity, limb amputation, peripheral edema, ascites
- Multiple or neurological trauma
- Multisystem organ failure
- Postoperative organ transplantation
- Sepsis
- Systemic inflammatory response syndrome
- Paralytic or barbituate agents

## Predictive Equations

Here are three commonly used predictive equations. There are other predictive equations you may use, depending on your area of practice. **Accuracy varies by equation and population.** Experience is helpful for an accurate selection and utilization of these predictive equations.

### **Abbreviations:**

- EER = estimated energy requirements
- REE = resting energy expenditure (kcal)
- A = age (years)

- PA = physical activity
- W = weight (kilograms)
- H = height (centimetres, unless otherwise specified)
- H\* = height (metres)

- Dietary Reference Intakes (DRI)
  - EER: age, physical activity, weight, height
  - Males:  $EER \text{ (kcal)} = 662 - 9.53A + PA \times (15.91W + 549.6H^*)$
  - Females:  $EER \text{ (kcal)} = 354 - 6.91A + PA \times (9.36W + 726H^*)$
- Harris Benedict (HB)
  - REE: weight, height, age
  - Males:  $REE \text{ (kcal)} = 66.5 + 13.75W + 5.0H - 6.78A$
  - Females:  $REE \text{ (kcal)} = 655.1 + 9.56W + 1.85H - 4.68A$
- Mifflin-St.Jeor (MSJ)
  - REE: weight, height, age
  - Males:  $REE \text{ (kcal)} = 9.99W + 6.25H - 4.92A + 5$
  - Females:  $REE \text{ (kcal)} = 9.99W + 6.25H - 4.92A - 161$
- Estimated Calories/kg

## Activity Factors

Most predictive equations evaluate resting energy expenditure (REE), meaning you need to consider physical activity energy expenditure in addition to the original calculation. The activity factor (AF) is applied to the REE value. Activity factors are not to be used with DRI equations.

**Activity Factors (AF) for various activity levels**  
**[\*] indicates activities obtained in healthy, free-living people**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

Activity Level	AF
<b>*Resting (lying or sitting)</b>	<b>1.0 - 1.4</b>
Lying still, sedated or asleep	0.9 - 1.1
Lying still, conscious	1.0 - 1.1
Spinal cord injury, 0-4 weeks post-injury	1.1
Bedrest (moving self around bed)	1.15 - 1.2
Mobilizing occasional on ward	1.15 - 1.4
<b>*Sedentary/ Light Activity (standing for long periods)</b>	<b>1.4 - 1.6</b>
Mobilizing frequently on ward	1.4 - 1.5
Regular, intensive physiotherapy	1.5 - 1.6
<b>*Moderate Activity (continuous movement/slow walking)</b>	<b>1.6 - 1.8</b>

## Stress Factors

Most predictive equations evaluate resting energy expenditure (REE), meaning you may need to consider energy expenditure from stress. The stress factor is applied to the REE value.

**Stress Factors (SF) for various clinical statuses**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

<b>Clinical Status</b>	<b>SF</b>
Cancer	0.8 – 1.5
Elective surgery	1.0 – 1.1
Peritonitis	1.05 – 1.25
Multiple/ long bone fractures	1.1 – 1.3
Fever	1.2 per 1°C > 37°C
Spinal cord injury, 0-4 weeks post-injury	1.2
Sepsis	1.2 – 1.4
Severe infection	1.2 – 1.6
Burns	1.2 – 2.0
Infection with trauma	1.3 – 1.55
Multiple trauma, traumatic brain injury	1.4

## Protein Requirements

The table below represents general guidelines for protein requirements according to how hypermetabolic your patient is. Consider your individualized patient to determine the most accurate protein requirement. Experience using these methods is helpful. You can consider calculating requirements using various methods and compare values.

**General protein requirements, by patient's hypermetabolic category**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

Patient Category	Protein (g/kg)
Not hypermetabolic: <ul style="list-style-type: none"> <li>• Adults not severely ill or injured</li> <li>• Adults not at risk of refeeding syndrome</li> <li>• Acute elderly patients</li> </ul>	0.8 – 1.5  (1.0 – 1.5 for acute elderly patients)
Moderately hypermetabolic, including: <ul style="list-style-type: none"> <li>• Post-operative (~14 days)</li> <li>• Repletion</li> <li>• Infection</li> <li>• Temperature &gt; 38°C</li> <li>• Head injury</li> <li>• COPD exacerbation</li> </ul>	1.2 – 1.5
Hypermetabolic, including multi-trauma	1.5 – 2.0

The following table represents a more detailed overview of protein requirements specific to various clinical conditions. This may be more useful for you during practice than the general guidelines, if your patient's clinical status is reflected in this table.

**Detailed protein requirements, by patient's clinical status  
Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

<b>Clinical Status</b>	<b>Protein (g/kg)</b>
Normal (non-stressed, non-depleted)	0.8 – 1.0
Postoperative	1.0 – 1.5
Sepsis	1.5 – 2.0
Multiple trauma	1.3 – 1.7
Traumatic brain injury	1.2 – 2.0
Burns	1.2 – 2.0
Catabolism	1.2 – 2.0
Refeeding syndrome	1.2 – 1.5
Cancer	0.8 – 2.0
Hemodialysis	1.1 – 1.2
CCPD/CAPD	1.2 – 1.3
CRRT	1.5 – 2.0
Acute Renal Failure	1.0 – 1.5
Chronic Kidney Disease	0.8 – 1.0
Mild-Moderate Stress	1.2 – 1.3
Moderate-Severe Stress	1.5 – 2.0
Severe + Wound Healing	1.5 – 2.0
HIV (asymptomatic)	1.0 – 1.4
HIV (symptomatic)	1.5 – 2.0
HIV (CD4 < 200/AIDS defining condition)	2.0 – 2.5

## Fluid Requirements

The table below represents general guidelines for calculating fluid requirements. Consider your individual patient prior to determining the best method to use. Experience using these methods is helpful. You can calculate requirements using various methods and compare values.

**General guidelines for fluid requirements**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

Based Upon	Method of Fluid Estimation
Weight	<ul style="list-style-type: none"><li>• 100 mL/kg for 1st 10 kg</li><li>• 50 mL/kg for next 10 kg</li><li>• 20 mL/kg for each kg &gt; 20 kg</li></ul>
Energy	1 mL per kcal
Age and weight	<ul style="list-style-type: none"><li>• 16 – 30 years, active: 40 mL/kg</li><li>• 20 – 55 years: 35 mL/kg</li><li>• 55 – 75 years: 30 mL/kg</li><li>• &gt; 75 years: 25 mL/kg</li></ul>
Fluid balance	Urine output + 500 mL/day

## Electrolyte Requirements

The table below represents general guidelines for electrolyte requirements, in consideration of clinical factors. Determination of the best method to use needs to be considered in the context of the individual and their current electrolyte status and bloodwork. This can vary tremendously based on the situation.

### General guidelines for electrolyte requirements

Electrolyte	Daily Requirements	Factors That Increase Needs
<b>Sodium</b>	1 – 2 mmol/kg	Diarrhea, vomiting, GI losses
<b>Potassium</b>	1 – 2 mmol/kg	Diarrhea, vomiting, medications, refeeding syndrome, GI losses
<b>Calcium</b>	5 – 7.5 mmol/day	High protein intake
<b>Magnesium</b>	4 – 10 mmol/day	Medications, refeeding syndrome, GI losses
<b>Phosphorous</b>	20 – 40 mmol/day	High dextrose loads, refeeding syndrome

## Sam's Nutritional Requirements

Review Sam's energy, protein, and fluid requirements.

For Sam's energy requirements, it is important to try different predictive equations to compare.

### **Harris Benedict equation for Sam:**

$$66.5 + 13.75(65.9) + 5.0(186) - 6.78(42) = 1618 \text{ (REE)}$$
$$\times 1.15 \text{ (AF: mobilizing infrequently)} \times 1.2 \text{ (SF: recent surgery, inflammation, and infection)} = 2233 \text{ kcal/day}$$

Regarding his activity factor: these are frequently overestimated. An AF of 1.15 is appropriate for an inpatient who is mobilizing occasionally around the ward. He is still fatigued, weak, deconditioned and is likely not getting up often to walk around.

Regarding the stress factor: an appropriate SF would be 1.0 – 1.2 because of his recent surgery, inflammation and infection. This could change with time and is why these requirements need to be frequently evaluated. In this case, the calculations reveal a range from 1980 to 2300 kcal/day. You can choose the average of these at 2300 kcal/day which provides 35 kcal/kg.

**Calories per kg calculation:**  $30 - 35 \text{ kcal/kg} \times 65.9 \text{ kg} = 1977 - 2307 \text{ kcal/day}$

**Sam's energy requirements:** ~2300 kcal/day (35 kcal/kg)

Protein requirements for Sam should range from 1.2 – 1.5 g/kg/day as he is post-operative and malnourished (physical signs of muscle wasting). Protein is also important in the context of his disease.

**Sam's protein requirements:** 79 – 99 g/day  
(1.2 – 1.5 g/kg/day)

Finally, Sam's fluid requirements are roughly 2300 mL/

day, but keep in mind that Sam has a recent ileostomy meaning he is not using his colon. Fluid intake and hydration is of high importance meaning this will likely need to be adjusted.

**Sam's fluid requirements:** 2300 mL/day (35 mL/kg)

## Biochemical Data

### Laboratory Values

In the hospital, you will have access to a variety of laboratory values. The table below represents common laboratory values to review for all patients. Depending on your patient's diagnosis, you may have to review additional values.

### Common laboratory values

Laboratory Value	Normal Range
Glucose (Random)	4.0 – 7.8 mmol/L
Sodium (Na <sup>+</sup> )	135 – 145 mmol/L
Potassium (K <sup>+</sup> )	3.5 – 5.0 mmol/L
Chloride (Cl <sup>-</sup> )	96 – 106 mmol/L
Phosphorus (PO <sub>4</sub> )	0.8 – 1.35 mmol/L
Calcium (Ca <sup>+2</sup> )	2.1 – 2.7 mmol/L
Magnesium (Mg <sup>+2</sup> )	0.63 – 0.94 mmol/L
Albumin (Alb)	35 – 50 g/L
Blood Urea Nitrogen (BUN)	3.0 – 7.0 mmol/L
Creatinine (Cr)	44 – 80 μmol/L
Total Cholesterol	< 5.2 mmol/L

## Sam's Biochemical Data: Lab Values

Review Sam's lab values in the table below. The "Notes" column indicates which values are outside of target range and explains how to correct calcium and magnesium when albumin values are <35g/L.

**Sam's laboratory values**

[\*] Indicates values outside the target range

Laboratory Value	Sam's Value	Notes
Glucose (Random)	6.5 mmol/L	N/A
Sodium (Na <sup>+</sup> )	135 mmol/L	N/A
Potassium (K <sup>+</sup> )	3.8 mmol/L	N/A
Chloride (Cl <sup>-</sup> )	102 mmol/L	N/A
Phosphorus (PO <sub>4</sub> )	1.1 mmol/L	N/A
Calcium (Ca <sup>2+</sup> )	<b>*1.9 mmol/L</b> corrected = 2.24 mmol/L	<p>Outside the target range</p> <p>Correct when albumin is &lt;35 g/L</p> <p>Corrected calcium = (normal albumin - abnormal albumin) × 0.02 + Ca<sup>2+</sup> value</p> <p>Corrected calcium for Sam: (40 - 23) × 0.02 + 1.9 = 2.24 (normal)</p>

<b>Magnesium (Mg<sup>2+</sup>)</b>	0.73 mmol/L corrected = 0.81 mmol/L	Correct when albumin is <35g/L Corrected magnesium = (normal albumin - abnormal albumin) × 0.005 + Mg <sup>2+</sup> value  Corrected calcium for Sam: (40 - 23) × 0.005 + 0.73 = 0.81 (normal)
<b>Albumin (Alb)</b>	*23 g/L	Outside the target range Albumin is <35g/L, requiring corrections for calcium and magnesium.
<b>Blood Urea Nitrogen (BUN)</b>	*1.6 mmol/L	Outside the target range
<b>Creatinine (Cr)</b>	56 µmol/L	N/A
<b>Total Cholesterol</b>	3.3 mmol/L	N/A

## IV Solutions

Here is an overview of common IV solutions used in hospital. IV solutions contribute calories and other nutrients, so they need to be considered when you are creating a nutrition care plan.

**Common IV solutions**  
**Adapted from the Sunnybrook Clinical Nutrition Resource Handbook**

<b>Solution</b>	<b>Kcal/L</b>	<b>Composition/L</b>
<b>Normal Saline (0.9% NaCl)</b>	0	Na - 154 mmol Cl - 154 mmol
<b>½ Normal Saline (0.45% NaCl)</b>	0	Na - 77 mmol Cl - 77 mmol
<b>D5W (5% Dextrose)</b>	170	Dextrose - 50 g
<b>D10W (10% Dextrose)</b>	340	Dextrose - 100 g
<b>5% Dextrose and 0.9% NaCl</b>	170	Dextrose - 50 g Na - 154 mmol Cl - 154 mmol
<b>⅔ and ⅓ (3.3% Dextrose and 0.3% NaCl)</b>	112	Dextrose - 33 g Na - 51 mmol Cl - 51 mmol
<b>Ringer's Lactate</b>	9	Na - 130 mmol K - 4 mmol Ca <sup>2+</sup> - 1.4 mmol Cl - 109 mmol Lactate - 28 mmol

# Dietary Data

Obtaining accurate dietary data can vary based on your patient (e.g. family members present, patient's cognitive ability, flow sheets or calorie counts, etc.), as well as the setting (e.g. inpatient compared to outpatient).

If possible, collect the following information:

- **Diet order(s):** Important for a representation of daily intake while in the hospital (can include enteral nutrition & supplements).
- **Dietary recall:** 24 hr recall (if recent admission or representation of food consumption in hospital), common eating patterns, or short-term and long-term representation of eating patterns or typical foods.
- **Calorie counts:** Depending on the patient, you may order calorie counts to monitor/determine how much/ what they are eating in hospital.

## Sam's Dietary Data

**Over the past 2 months,** Sam's diet consists mainly of fluids and small portion of bland foods (fruit, bread, rice, cereal) due to nausea, pain and loss of appetite.

**Over the past 2 weeks** (prior to hospital admission), Sam was not eating or drinking much due to feeling severely

unwell, fatigued and having no appetite. Estimated caloric intake ~ 600 kcal per day.

**Sam's common foods or drinks:**

- Two cans of vanilla Ensure® Plus per day
- Fruit juices, Gatorade, water, coffee, tea – reports drinking consistently throughout the day

**Supplements:** Vitamin D (1000 IU/day) and Calcium Carbonate (500 mg/day)

**Current hospital diet order:**

- Clear fluids (on day 1 tolerating and consuming ~800 mL of water and juice) – RD to consult for progression.
- Receiving IV  $\frac{2}{3}$  and  $\frac{1}{3}$  @ 100 cc/hour – provides 269 kcal/day and 122 mmol of Na and Cl
- *Practice calculating this using the IV solutions table provided earlier*

# Assessment summary

## Summary of Sam's Assessment Data

Review the final summary for Sam's assessment data. In practice, it is good to have a summary of this information with you at all times and to keep track of the progression of your patient.

### Summary of Sam's Assessment Data

Area	Key Data
Clinical Data	<ul style="list-style-type: none"> <li>• 42 year old male with Crohn's disease – recent ileocecal resection resulting in removal of 70 cm of terminal ileum with temporary ileostomy.</li> <li>• Medications: prednisone (30 mg/day IV), metronidazole (500 mg IV), pantoprazole (40 mg IV)</li> <li>• Clinical documentation               <ul style="list-style-type: none"> <li>◦ Day 0 post-op: Patient NPO with ice chips, IV <math>\frac{2}{3}</math> and <math>\frac{1}{3}</math> started at 100 mL/hour (2400 mL/day), patient reports feeling nausea and fatigued, ostomy output was 200 cc.</li> <li>◦ Day 1 post-op: Patient switched to clear fluids, IV fluids running at the same rate, patient reports feeling better and is drinking + walking, ostomy output was 1200 cc.</li> </ul> </li> <li>• Medical plan: monitor in hospital for 3-5 days (pending complications and tolerance), home once stable, plan to complete resection in 3 months.</li> </ul>
Anthropometric and Physical Assessment Data	<ul style="list-style-type: none"> <li>• Height = 186 cm, Weight = 65.9 kg (81.2 kg usual weight), BMI = 19.1 kg/m<sup>2</sup>, 19.4% weight loss in 2 months (severe).</li> <li>• Moderate muscle wasting and subcutaneous fat loss.</li> </ul>
Nutrition Requirements Data	<ul style="list-style-type: none"> <li>• Energy = 2,300 kcal/day (35 kcal/kg), Protein = 79 to 99 g/day (1.2-1.5 g/kg/day), Fluid = 2,300 mL/day (35 mL/kg).</li> </ul>
Biochemical Data	<ul style="list-style-type: none"> <li>• Low BUN (1.6) and Albumin (23), electrolytes within range (monitor).</li> </ul>

Dietary Data	<ul style="list-style-type: none"><li>• History: poor appetite, diet consisting of mainly fluids over the past 2 weeks</li><li>• Diet order: clear fluids (day 1: ~800 mL of fluid consumed) - RD to progress</li><li>• Supplements: Vitamin D (1000 IU/day) and Calcium Carbonate (500 mg/day)</li><li>• Receiving IV fluids (2400 mL per day) providing 269 kcal and 122 mmol of Cl and Na</li></ul>
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PART 1: ASSESS COMPLETE. Please take a few minutes to think about the assessment data collected. When you're ready, move on to Part 2: Plan.

# Plan



## Team Rounds

Team rounds are an opportunity to collaborate and communicate with the interdisciplinary team about your patient's care plan and gather important information on their diagnosis, prognosis, consults, current status, expected progression, next steps and disposition planning. In an in-patient setting, this is how you will start your day and help inform you about your patients care plan.



A doctor, nurse, and other medical staff are pictured conducting rounds in a hospital. [Photo by Madailein Abbott](#) is licensed under [Public Domain](#).

# Common PES Statement Terminology

As you interpret the data from the assessment, you can form PES statements or nutrition diagnoses that help identify nutrition concerns that need to be addressed in your plan. If you are not familiar with how to write a PES statement please review this [resource from the Academy of Nutrition and Dietetics](#). Here are some common nutrition problems:

- Inadequate energy intake
- Inadequate protein intake
- Inadequate oral intake
- Inadequate fluid intake
- Increased nutrient needs
- Malnutrition
- Inadequate vitamin/mineral intake
- Swallowing difficulty
- Impaired GI function
- Intake of unsafe food
- Physical inactivity
- Inability or lack of desire to manage self-care

## Sam's PES Statements

Based on our assessment, here are some examples of PES statements for Sam.

- Inadequate protein-energy intake related to progressive Crohn's disease flares as evidenced by dietary recall (low protein and energy intake), loss of appetite and severe weight loss (19.4%).
- Inadequate oral intake related to progressive Crohn's disease flares as evidenced by loss of appetite, dietary history (consumption of ~600 kcal/day) and severe weight loss (19.4%).
- Malnutrition related to a 2-month history of worsening Crohn's disease and poor dietary intake as evidenced by dietary history (consumption of ~600 kcal/day), severe weight loss (19.4%), and physical assessment of moderate muscle wasting and loss of subcutaneous fat.

**Practice writing other PES statements for Sam!**

## Creating a Nutrition Care Plan

When creating a nutrition care plan you will utilize your assessment data. Often, you will have an extensive amount of assessment data, some of which is relevant to your nutrition care plan and other data that is not. It is still important to collect and seek out all this data as it will inform your direction, but it is also important to create priorities based on your patient and their needs. In this case, a few key areas to consider for our nutrition care plan include:

- **Tolerance:** Does the patient have any symptoms, complaints, or complications? If so, does this impact the nutrition care

- plan? Is the complication a result of the nutrition care plan?
- **Inputs and Outputs:** What is the patient's ostomy and urine output? What orders is the patient receiving?
  - **Labs:** Are the patient's laboratory values normal? Have they changed? Did they receive replacements?
  - **Orders:** What is the diet order? Changes in medical (medications, IV fluids) orders? What other orders may impact the nutrition care plan? Does it need to be changed?
  - **Dietary Intake:** Is the patient eating and drinking? Is it sufficient? Need for supplements? Changes to the nutrition care plan?
  - **Education:** What does the patient already know? What education do they need to be provided? Do they need RD follow-up?

## Sam's Priorities for Nutrition Care

Based on Sam's assessment data, it is important to **create priorities for nutrition care**. Here are a few priorities for Sam for the purposes of this case study. It is important to remember that there may be other considerations in practice or more complex cases:

- **Diet progression:** while in hospital it is important to progress Sam's diet to recommendations (as tolerated). He is malnourished so it is important to emphasize intake.
- **Monitoring:** complications that influence the

nutrition care plan and Sam's medical status need to be monitored. This includes ostomy outputs, fluid intake, and electrolyte imbalances.

- **Oral intake:** Sam is malnourished with recent severe weight loss and evidence of muscle wasting. It is important to prioritize (when possible and as tolerated) increasing his caloric and protein intake.
- **Education:** remind Sam of IBD recommendations and provide ostomy education (re-recent ileostomy) for adherence in and outside of the hospital to reduce the risk of complications.

## Nutrition Care for Inflammatory Bowel Disease (IBD)

The key purposes of nutrition care for IBD are to:

- Prevent or minimize gastrointestinal symptoms
- Prevent malnutrition
- Prevent micronutrient deficiencies
- Normalize bowel function
- Improve quality of life

### Calorie Counts

Calorie counts are a tool in hospital to evaluate intake. There are

limitations with calorie counts, but they are commonly used and easy to implement.

For calorie counts to be effective, it is important that you plan with your interdisciplinary team. Communicating with the nurse and patient is essential to receiving accurate and useful information.

The patient or nurse (depending on ability) will fill out the hospital order sheet for each meal by indicating how much of the meal, snack, or drink was consumed. It is important to remind the patient and nurse to document any outside meals (if applicable).

It is up to you (the Dietitian) to evaluate the intake by estimating the caloric, protein and fluid amounts in each meal (resulting in a daily intake to compare against your estimated requirements). You can also talk to the patient (24hr recall, if warranted) or the nurse to determine the accuracy of the documentation.

Calorie counts are completed as an “order” in the patient’s chart, and it is important to go to the patient’s room each day to receive and evaluate the intake.

## Nutrient Deficiencies

Here are a few nutrient deficiencies to be aware of associated with IBD. You should seek further readings and details regarding these nutrients and common treatments:

- **Vitamin B12:** increased risk with extensive inflammation in the ileum or removal of it.
- **Folate:** increased risk with sulfasalazine use or extensive inflammation in the jejunum or removal of it.
- **Vitamins D, E, K:** increased risk with inflammation of large portion of jejunum or ileum.
- **Magnesium:** increased risk with extensive inflammation, chronic diarrhea, or removal of large portions of jejunum or ileum.

- **Calcium:** increases risk with avoidance of dairy foods for lactose intolerance, prednisone use, extensive inflammation in small intestine.
- **Potassium:** increased risk with chronic vomiting and diarrhea or prednisone use.
- **Iron:** increased risk with blood loss from ulceration of colon or clinical signs of deficiency.

## Sam's Nutrition Care Plan: IBD

Sam was diagnosed with Crohn's 5 years ago. It is likely that he has received education for nutrition and management of symptoms and complications. However, it is important to still ask Sam if he has received this education and provide him with the opportunity to ask you questions.

- **Implement calorie counts:** Sam is malnourished (as a result of his worsening Crohn's disease) and it may be worthwhile to evaluate the progression of his intake while in hospital.
- **Education:** In light of recent surgery and treatment, emphasize and educate about high calorie and protein diets. Educate Sam about the risk of malabsorption and importance of nutrition.
- **Supplements:** continue with Vitamin D and Calcium supplements. In light of recent surgery (removal of 70cm of terminal ileum), may want to

consider liaising with patient and team regarding B12 injections and other supplements (fat-soluble vitamins).

## Nutrition Care for Ostomies

The key purposes of nutrition care for ostomies are to:

- Minimize the risk of obstruction or stoma blockage
  - In the first 6 to 8 weeks. Low residue (to prevent food blockage) and high in soluble fibre to slow down transit time and aid with water absorption; therefore, minimize risk of dehydration.
- Prevent fluid and electrolyte imbalances and prevent dehydration
- Reduce excessive output
- Minimize gas and unpleasant odors
- Maintain weight (calories and protein)
- Manage potential micronutrient deficiencies

After surgery, the diet will begin with clear fluids and can progress slowly in the following order:

1. **Clear fluids:** concentrated fruit juices (apple, grape) may need to be diluted to prevent osmotic diarrhea.
2. **Full fluids**
3. **Small portions of food:** low residue, well cooked, and well chewed. Patient may find it easier to eat 4 – 6 small meals per day.

4. **Regular diet:** should be achieved by 6 – 8 weeks after surgery.

Here are some additional considerations:

- Diet is based on individual food tolerances, which are highly variable.
- Foods high in soluble fiber (e.g. oatmeal, applesauce, banana, and rice) may help reduce fluid losses.
- Evaluate patient risk for micronutrient deficiencies. Patients who have had extensive resection (removal >100 cm of terminal ileum) may experience deficiencies of fat-soluble vitamins, vitamin B12 and bile salts. In such cases, consider the need for supplements and B12 injection.
- The patient's diet should be progressed during hospital admission with education provided by RD to continue and manage after discharge.

### Nutrition management guidelines for ostomies

	<b>High output ostomy (ileostomy, jejunostomy)</b>	<b>Low output colostomy</b>
<b>Fibre</b>	<ul style="list-style-type: none"> <li>• Low insoluble fibre</li> <li>• Increase soluble fibre</li> </ul>	<ul style="list-style-type: none"> <li>• High fibre-all sources</li> </ul>
<b>Fluids</b>	<ul style="list-style-type: none"> <li>• Oral Electrolyte Replacement (OER)</li> </ul>	<ul style="list-style-type: none"> <li>• Increase fluid from all sources to promote regularity and minimize strain</li> </ul>
<b>Electrolytes</b>	<ul style="list-style-type: none"> <li>• Need to add potassium and sodium</li> </ul>	<ul style="list-style-type: none"> <li>• No additions required</li> </ul>
<b>Sugars</b>	<ul style="list-style-type: none"> <li>• Low simple sugar</li> </ul>	<ul style="list-style-type: none"> <li>• As desired</li> </ul>
<b>Vitamin/ Minerals</b>	<ul style="list-style-type: none"> <li>• Usually necessary</li> <li>• Especially B12 and sometimes Magnesium</li> <li>• Suggest daily multivitamin</li> </ul>	<ul style="list-style-type: none"> <li>• Not usually needed</li> </ul>

## Sam's Nutrition Care Plan: Ileostomy

Sam is tolerating clear fluids and increasing his oral intake.

It is now day 2 post-op and based on the assessment data including tolerance, outputs, physical assessment, and laboratory values, we can take the next step of moving to full fluids.

- **Order Ensure® Vanilla Plus** with breakfast, lunch and dinner (if consumed, provides 1050 kcal and 39 g of protein): Sam was drinking this supplement prior to hospital admission and he is moderately malnourished. It is important to include fluids that increase his caloric and protein intake while he is on the full fluid diet.
- **Monitor ostomy output:** if outputs do not start to decrease <1 L (ideally an average of 750 mL) consider modifications (liaise with team, diet order changes).
- **Continue to drink fluids:** emphasize the importance of fluids and sources of electrolytes (education) to Sam. Recommend including an Oral Rehydration Solution.
- **Education:** provide education on minimizing bowel obstruction risk, managing high outputs, preventing fluid/ electrolyte imbalances, and managing gas and odour.

# Nutrition Care for Pancreatitis

**Note:** This section of the Plan stage does not concern our client Sam, and is meant to provide a brief overview of nutrition care considerations for pancreatitis. You should seek further readings and educational resources on pancreatitis.

In general, macronutrient requirements for pancreatitis are as follows:

- Calories: 25 – 35 kcal/kg/d
- Protein: 1.2 – 1.5 g/k

The table below provides an general overview of factors that cause deterioration of nutritional status in acute and chronic pancreatitis.

**Factors that deteriorate nutritional status of patients with acute and chronic pancreatitis**

<b>Factors</b>	<b>Acute Pancreatitis (degree of deterioration)</b>	<b>Chronic Pancreatitis (degree of deterioration)</b>
<b>Hypermetabolism</b>	significant	moderate
<b>Reduced oral intake</b>	significant	moderate
<b>Nausea, vomiting</b>	significant	moderate
<b>Altered CHO and fat metabolism</b>	significant	moderate
<b>Abdominal pain</b>	significant	significant
<b>Protein loss (diarrhea, fistulas, inflammation)</b>	significant	significant
<b>Delayed gastric emptying</b>	moderate	significant
<b>Continued alcohol abuse</b>	moderate	significant
<b>Maldigestion, malabsorption</b>	moderate	significant
<b>Gastric outlet obstruction</b>	moderate	significant

## Chronic Pancreatitis

These are considerations for patients with chronic pancreatitis:

- When energy expenditure >110% of predicted values, a higher calorie intake is typically recommended (35 g/kg/day, especially if weight gain is required)
- Most patients can be treated with a regular diet supplemented with pancreatic enzymes.

Principles of chronic pancreatitis management include:

- preventing hypoglycemia and hyperglycemia
- preventing the exacerbation of malnutrition
- improving healthy eating
- reducing the risk of associated co-morbidities

Education for patients with chronic pancreatitis should include the following:

- **No smoking:** general recommendation, other healthcare providers may provide education for smoking cessation
- **Pain management:** general recommendation, other healthcare providers involved
- **No alcohol:** RD or general recommendation, depending on degree of abuse or need for counselling
- **Pancreatic enzymes** when required: RD recommendation, coordination and implementation but will involve other team members
- **Blood sugar management:** RD recommendation, coordination and implementation but will involve other team members
- **Low fat diet** emphasizing restriction of saturated fats (e.g. Mediterranean diet): RD recommendation

For each of the education topics listed above, ask yourself:

- Why is this important?
- How does this relate to the principles of management for chronic pancreatitis?
- How would I explain these to a patient?
- Are there further readings and resources I can seek on implementing and providing plain-language education?

# Acute Pancreatitis

For acute pancreatitis, there are two general categories: mild and severe. These result in a differing approach to nutrition care.

## **Mild acute pancreatitis:**

- Has little effect on metabolic rate.
- Oral diet initiation as soon as possible (if there is no nausea or vomiting, and abdominal pain has resolved). It is important to still encourage an oral diet even if the patient has pain. If this is the case, coordinate with the team for pain medications and suggest small frequent meals. Oral Nutrition Supplements (ONS) are often tolerated better than solid food because the patient requires smaller volumes to achieve daily estimated requirements (especially in a case where the patient has a history of alcohol abuse).
- Clear fluids vs regular low-fat diet (evaluate patient tolerance).
- If unable to tolerate due to pain, nausea, vomiting – the patient should be allowed to self-advance to regular diet as tolerated.

## **Severe acute pancreatitis and necrotizing pancreatitis:**

- Substantial protein catabolism and increased energy requirements.
- Stress hyperglycemia and insulin resistance is common.
- Early nutrition support is indicated (initiate as soon as possible within 48 hours of admission).
- Oral diet, if tolerated and intake is optimal/ meeting needs. If not, enteral nutrition (EN) preferred (refer to [Enteral Nutrition](#)).
- Continuous EN infusion preferred.
- Gastric or jejunal feeding is safe/ appropriate – seek further readings regarding tube placement.
- Parenteral nutrition (PN) indicated only when EN is not feasible or poorly tolerated (i.e. persistent ileus, small bowel

obstruction, or complex pancreatic fistula).

## Nutrition Care Plan Summary

### **Sam's Nutrition Care Plan: Summary**

Review the final summary for Sam's nutrition care plan.

### Summary of Sam's nutrition care plan

Priority Area	Plan
Diet Progression	<ul style="list-style-type: none"> <li>• Progress to full-fluid diet on day 2</li> <li>• If tolerated, progress to regular low-residue diet on day 3-4</li> </ul>
Monitoring	<ul style="list-style-type: none"> <li>• Monitor ostomy outputs</li> <li>• Monitor laboratory values, specifically electrolytes</li> <li>• Monitor fluid intake and urine output</li> </ul>
Oral Intake	<ul style="list-style-type: none"> <li>• Implement calorie counts while in hospital to evaluate intake and progress with changes to diet order</li> <li>• Include Ensure Plus (vanilla) with breakfast, lunch and dinner</li> <li>• Include ORS to prevent dehydration</li> </ul>
Education	<ul style="list-style-type: none"> <li>• Inflammatory bowel disease review: nutrition during flares and maintenance. Since Sam is malnourished resulting from his Crohn's disease, it is important to provide education on increasing caloric and protein intake.</li> <li>• New ileostomy education (6-8 weeks post-op &amp; maintenance): minimizing bowel obstruction risk, managing high outputs, controlling gas and odour, and fluid/electrolyte intake.</li> </ul>

PART 2: PLAN COMPLETE. Pause to reflect on the

nutrition care plan we created for Sam. When you're ready, move on to Part 3: Implementation.

# Implement



## Interdisciplinary Team

Review the roles and members of the interdisciplinary team. Depending on the patient's medical plan and condition, there may be other members involved. However, this is typical of an inpatient gastroenterology team.

- **Registered Dietitian:** primarily responsible for nutrition care plan, transition to oral diet, nutrition education.
- **Medical Doctor (MD) or Nurse Practitioner (NP):** medical update, enter orders for IV fluids, labs, imaging, medications, consults.
- **Pharmacist (RPh):** drug and nutrient interactions, medication dosing/ indications.
- **Nurse (RN, ostomy nurse):** help implement nutrition care plan, provide clinical information, manage ostomy care.
- **Physiotherapist (PT):** ambulation, positioning, assist with obtaining body weight.
- **Occupational therapist (OT):** cognitive assessment to determine if patient can provide accurate information, modified eating equipment, positioning.
- **Social Worker (SW):** provide counselling, disposition planning and identify sources of emotional support for patients and their families.
- **Speech language pathologist (SLP):** prevent, assess, diagnose,

and treat speech, language, social communication, cognitive-communication, and swallowing disorders.

- **Gastroenterologist (GI):** GI specialists primarily diagnose and treat GI diseases.
- **General Surgeon:** the surgeon is responsible for completing the surgical procedure, determining protocols and follow up.
- **Spiritual Care:** responds to the needs of the patient when faced with trauma, ill health or sadness and can include the need for meaning, for self worth, to express oneself, for faith support, prayer or sacrament, or simply for a sensitive listener.

## Education

When implementing your plan with your patient you may need to provide some education to them. When educating patients, try to:

- **Individualize the education as much as possible:** Discuss high-risk topic first since they are the priority, connect the patient's goals to your plan, and focus on what they want to learn.
- **Find out if patient has had previous education:** Ask the patient if any one else has talked to them, and adjust your education accordingly.
- **Focus on a few key messages:** If the patient is newly diagnosed or doesn't know much about IBD or ostomies, try not to overwhelm them with too much information during your first couple of interactions
- **Use visuals and resources** to convey your message whenever possible: You can provide your patient with detailed information in resources, but emphasize the key components based on the patients needs when speaking with them.

## Sam's Education

Recall from our nutrition care plan that we want to provide Sam with a review of inflammatory bowel disease (IBD) and new education for ileostomy.

- **IBD review** topics:
  - Management during an acute episode and while controlled
  - Recommendations for increasing energy and protein intake, as Sam is malnourished and could benefit from this
- **New education for ileostomy** topics:
  - Including sodium and potassium foods and drinks (electrolytes)
  - Minimizing bowel obstruction risk
  - Managing high ostomy outputs
  - Controlling gas and odour

Given that there are multiple education topics for Sam, you may want to consider providing education over 2–3 days to not overwhelm the patient. You can also be transparent and ask the patient what they would prefer.

# Education for IBD

## Importance of Nutrition

It is important to remind your patient of why nutrition is important in IBD. Making sure that your patient understands the implications of their disease and can help promote adherence to guidelines and attention to nutrition. When providing education, try to present information in a respectful and cautious way (not to discourage or overwhelm the patient).

You can do so by giving a quick overview of the **reasons they are at risk for malnutrition:**

- **Inadequate food and fluid intake:** resulting from nausea, abdominal pain, and loss of appetite.
- **Increased losses:** inflammation during acute flares resulting in increased protein losses and losses from diarrhea and bleeding.
- **Increased nutritional needs:** inflammation or infection increases metabolic requirements.
- **Malabsorption:** if the patient has severe inflammation, resection of the small intestine, and is on certain medications (i.e. prednisone), they have an increased risk of malabsorption.

## Managing IBD

Review the areas you may want to educate on depending on the patient's knowledge of IBD. It is important to distinguish between when IBD is in remission or under control and when an individual has an acute episode of IBD.

**When IBD is in remission or under control:**

- When you feel well, it is important to eat healthy so you build-up your strength and remain well nourished. Regular exercise like brisk walking, biking and swimming for at least 150 minutes (2 hours) each week is also important for good health.
- High-fibre diet (as tolerated), focusing on soluble fibre or supplements (Metamucil®). Avoid foods that cause symptoms.
- Drink plenty of fluids.
- Unnecessary restrictions should be avoided to maximize nutrient intake (patients with IBD commonly restrict intake due to association with fullness, pain, diarrhea – so risk of malnutrition is high).
- Micronutrients that are insufficient or malabsorbed in IBD patients may include iron, calcium, selenium, folate, thiamin, vitamin B12, zinc, magnesium, vitamins A, D, E. Consider multivitamins or supplementation, if dietary intake is insufficient.

#### **During an acute episode of IBD:**

- An individual will typically be put on bowel rest in hospital with IV fluids. They will then progress to clear fluids and a low-residue diet, slowly adding back foods to evaluate tolerance.
- A lower fibre diet (insoluble fibre) may prevent risk of obstruction
- For patients experiencing diarrhea, emphasize:
  - eating small meals frequently
  - drinking plenty of fluids to replace fluids
  - avoiding sugary drinks, alcohol and caffeine
  - including soluble fibre
- Where possible, try to maximize caloric and protein intake to prevent weight loss and malnutrition
- For patients at risk of malnutrition or experiencing poor appetite, emphasize a high-calorie and high protein diet divided into small, frequent meals which is better tolerated and maximizes nutritional intake

## Energy and Protein Intake

If patients are malnourished with IBD, it may be worthwhile to provide recommendations for increasing energy and protein intake.

**General recommendations for increasing energy and protein intake include:**

- Eat or drink often. Aim to have a meal or snack every two to three hours.
- Drink your fluids at the end of meals or snacks as they can fill you up.
- Have ready-to-eat, small, high energy and protein foods on hand, such as yogurt, pudding, granola, or protein bars, cheese or peanut butter and crackers, nuts and seeds, or trail mix.
- Provide your patient a list of foods that add protein or energy to meals (\*consider recommended foods in the context of the patient – i.e. ostomy guidelines, tolerance):
  - Add nut butters to smoothies, puddings, yogurt
  - Add extra sources of fat to meals: oil, butter, dressing, cheese, avocado
  - Choose high protein nutrition supplements

Again, these are general and non-comprehensive key points that should be expanded on in practice. Consider your recommendations in the context of the individual and the disease. For example, do not recommend including nuts and seeds to increase calories, if it does not adhere to the ostomy guidelines. It would be beneficial to seek readings and resources that cover this topic in more detail.

## Medications

It is important to remind your patient of the nutritional implications of medication use. They may have already received this from the pharmacist or another health professional, but it is appropriate to ask and make sure. This is especially important if you are recommending a supplement related to medication use (such as prednisone and calcium supplementation), in order to explain why you are doing so.

For example, a patient taking Prednisone should know the following:

- Prednisone causes decreased absorption of calcium and phosphorus from the small intestine. It also causes increased losses of calcium, zinc, potassium and vitamin C.
- With continual use of high doses of prednisone, the result may be bone loss and development of bone disease.
- Protein needs also are increased for people taking prednisone because it increases protein breakdown in the body.

## Education for Ileostomy

### Minimizing Bowel Obstruction Risk

Individuals with a new ileostomy are at greater risk for a stoma blockage than someone with a colostomy for several reasons. First, the stoma created from the ileum (small intestine) is smaller in diameter than one created from the colon. In addition, post surgical inflammation of the bowel is normal but results in a smaller exit site in the first 6 – 8 weeks and large particles of food don't break down

easily. These particles can get stuck where the stoma is, creating a blockage.

When providing education to patients, address the following topics.

- **Know the signs of a stoma food blockage:**
  - Abdominal cramps, pain or distension
  - Watery stools with bad odor
  - Stool released in spurts
  - Absence of stool output, or pressure at the stoma but little stool output
- **Avoid or minimize certain foods for the first 6 – 8 weeks:**
  - High-fibre/ high residue foods, as foods with large fibres do not digest in the upper small intestine
  - Vegetables and fruits with skins
  - Raw fruits and vegetables – cook them well
  - Nuts and seeds
  - Popcorn
  - Meats/ casings
- **Focus on the 3 C's:**
  - Cook tender
  - Cut small
  - Chew well
- **Stay hydrated:**
  - Prevent dehydration by drinking 8-10 cups of fluid a day (2 – 2.5 L). This can include different types of liquid besides water, but half the amount should be water.
  - Keep in mind that caffeinated drinks can add to dehydration
  - Sip liquids slowly and consistently throughout the day
  - Drink fluids with electrolytes such as sodium and potassium that are low in sugar (or an oral electrolyte solution)

## Electrolytes

Educate clients with the following information to incorporate electrolytes in their diet.

- **High potassium foods:** Kiwi, avocado, mango, cantaloupe and honeydew melon, banana, orange juice, dried fruit (apricots, dates, figs, raisins), potatoes, potato chips, spinach, swiss chard, rapini, tomatoes, squash, brussels sprouts, beets, parsnip, legumes and beans, peas, lentils, nuts, seeds, coconut, chocolate.
- **High sodium foods:** All canned vegetables and vegetable juices, processed cheese and meat slices, canned, pickled or smoked fish, salted crackers, pretzels, canned products and soups, Ovaltine, soda water, artificial fruit-flavoured crystals, or add salt to food.
- **Products with electrolytes:** Gastrolyte, Pedialyte, ORS rehydration salts, G2 (low sugar Gatorade), vegetable juices.

## High Ostomy Outputs

High ostomy outputs can often be reduced by modifying a patients' diet. Research has shown soluble fibre helps to control diarrhea by thickening the stool and prolonging the travel time of foods through the bowel.

A normal ileostomy output is less than 1.2 L (1200 mL) per 24 hours. The goal is to have an output between 600-900 mL per 24 hours. It is considered diarrhea if the output is > 1 L.

Provide the following recommendations to patients:

- **Include soluble fibre:** applesauce, peeled peaches, apricots,

banana, melons, potatoes, squash, lentils, beans, barley, oatmeal, psyllium.

- **Avoid insoluble fibre:** fruits and vegetable skins and seeds, wheat bran, whole grains, nuts and seeds.
- **Include an oral electrolyte replacement:** Gastrolyte or Gatorade (diluted); add salt.
- May be helpful to **separate liquids and solids** by up to 1 hour.
- **Avoid consuming certain foods and drinks:** lactose (may still be able to tolerate yogurt/cheese), fatty or greasy foods, foods that are natural laxatives (prunes, figs, licorice), caffeine (e.g. coffee, chocolate, soft drinks), alcohol, simple sugars (juices, etc)

Patients should be made aware of the following foods:

- **Foods that may cause or worsen diarrhea:** Sweetened milk and milk products, fruit juices and punches, sweet breads/rolls/cakes/cookies, sweet cooking sauces, sugars (including honey, syrup, jams), alcohol, spicy foods, caffeine, very high fat or greasy foods.
- **Foods that may thicken stool:** Bananas, rice, tapioca, barley, oatmeal, applesauce, cheese, smooth peanut butter, and potato chips. Metamucil® or Benefibre® supplements also contain soluble fibre to thicken stools.

## Controlling Gas and Odour

It is normal for stool to have an unpleasant odour, which comes from bacteria in the colon that help break down digested food. Recommendations should be offered to the patient for quality of life outside of the hospital.

Provide the following recommendations to help patients **prevent gas and odour:**

- Make sure you are not lactose intolerant
- Avoid high fat foods and carbonated drinks
- Maintain a regular eating pattern (i.e. meal and snack times, do not skip meals)
- Exercise regularly
- Eat slowly
- Avoid swallowing air (e.g. gulping, chewing gum, use of straws, eating quickly)

Patients should be made aware of the following foods:

- **Foods that cause gas and odour:** Asparagus, apples, banana, beer, broccoli, brussels sprouts, cabbage, carbonated drinks, cauliflower, corn, cucumber, dairy products, dried beans, eggs, fatty foods, grapes, melons, onions, prunes, turnips.
- **Foods that may help relieve gas and odour:** Yogurt with active cultures, buttermilk, cranberry juice.

## General Eating Guidelines

It is important that individuals with permanent ostomies follow guidelines to prevent concerns, but also transition to a less restrictive diet for **quality of life**. Here are some important guidelines for a patient who is no longer in the post-operation period (6 – 8 weeks, based on tolerance and the individual):

- Eat 3 well balanced meals daily or 5 – 6 small meals
- Avoid skipping meals or long gaps between meals, which can contribute to gas production
- Avoid drinking out of straws, as they allow air to be swallowed and can contribute to gas production
- Eat slowly to avoid swallowing air, and always chew your food well

- Drink adequate amounts of fluids (8–10 glasses a day)
- Add new foods gradually to learn which foods might give you side effects, such as excess gas, odour, constipation, or loose stool
- Work with a dietitian if symptoms are not being managed

## Summary of Education

### Sam's Education: Key Messages

Here are the key messages that should be emphasized to Sam as a result of his needs and assessment data. Take a minute and think of other key messages you would make for Sam and how you would explain it to him.

#### **Key Messages:**

- Increase your caloric and protein intake by eating 5 – 6 small meals that include foods that are nutrient dense (from the resource list provided).
- Avoid high-fibre (insoluble fibre) / high residue foods in the first 6 – 8 weeks of recovery.
- Focus on the 3 “C’s” – cook tender, cut small, chew well.
- Stay hydrated by drinking 2 – 2.5 L of fluids a day (minimum), include fluids with electrolytes such as

vegetable juices or low sugar Gatorade.

- Include sources of soluble fibre to decrease ostomy outputs if they remain high (> 1 L in a 24 hour period).

## Simulation Activity: Sam



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.library.torontomu.ca/dietmods/?p=142#h5p-65>

PART 3: IMPLEMENT COMPLETE. Please reflect on the implementation strategies discussed. When you are ready, move on to Part 4: Evaluate.

# Evaluate



## Evaluating the Nutrition Care Plan

After you have implemented the plan, you want to follow-up and evaluate it to see if it has been effective in addressing your nutrition concerns. This can help you to decide on appropriate changes to make to the nutrition care plan moving forward.

When evaluating your plan in a inpatient setting, you will need to gather updated information from the same key areas of nutrition concern that you identified in your initial assessment. This will include, but is not limited to, the diet order, daily inputs and outputs, malnutrition, laboratory values, education, and the medical care plan.

**Questions to evaluate nutrition care plan effectiveness, by issue type**

<b>Common Nutrition Issues</b>	<b>Questions to Evaluate Effectiveness of NCP</b>
Diet	<ul style="list-style-type: none"> <li>• Are they tolerating current dietary order?</li> <li>• Are they eating and drinking? If calorie counts available – how much? Macronutrient distribution?</li> <li>• Does the patient have any complaints or concerns?</li> </ul>
Daily Input and Output	<ul style="list-style-type: none"> <li>• Fluid balance? Ostomy output? Urine output?</li> <li>• GI tolerance? Does the patient have any complaints?</li> <li>• Changes in IV fluids?</li> </ul>
Malnutrition	<ul style="list-style-type: none"> <li>• Has weight changed (depending on length of stay or readmission)?</li> <li>• Has energy/ lethargy improved?</li> <li>• Changes in appetite?</li> </ul>
Abnormal Electrolytes	<ul style="list-style-type: none"> <li>• Electrolytes normal?</li> <li>• Are laboratory values being checked on an appropriate schedule &amp; replaced in a timely manner?</li> </ul>
Education	<ul style="list-style-type: none"> <li>• Did the patient understand your education? Do they have any questions?</li> <li>• Do they require outpatient follow up?</li> </ul>
Medical Care Plan	<ul style="list-style-type: none"> <li>• Are there any changes to the medical care plan?</li> <li>• Changes in medications that impact the nutrition care plan?</li> <li>• Any updated laboratory work, procedures, or assessments (MD, PT)?</li> <li>• Disposition planning? Does this impact your nutrition care plan?</li> </ul>

## Evaluating Sam's Nutrition Care Plan

Review the evaluation chart for Sam's nutrition care plan. This chart is a representation of our evaluation on day 3 based on what we implemented on day 2.

**Outcomes of Sam's nutrition care plan, by issue type**

<b>Common Issues</b>	<b>Evaluate effectiveness of NCP</b>	<b>Sam's outcomes</b>
<b>Diet</b>	<ul style="list-style-type: none"> <li>• Tolerating full fluid diet.</li> <li>• Calorie counts reveal intake of ~ 1300 kcal/day (drinking 3 vanilla Ensure +, Gatorade and apple juice)</li> <li>• Oral fluid intake estimated at 1500 mL.</li> <li>• Patient reports appetite is improving each day.</li> </ul>	<ul style="list-style-type: none"> <li>• Progress to low residue diet on day 3 (as planned). Emphasize importance of soluble fiber.</li> <li>• You may consider liaising with MD to reduce IV fluids (50 – 75 cc/ hour). Sam continues to improve his oral intake of fluids (but consider other factors – laboratory values, absorption of fluid, etc)</li> </ul>

<p><b>Daily Input and Output</b></p>	<ul style="list-style-type: none"> <li>Ostomy output 1.5 L on day 3.</li> <li>Receiving <math>\frac{2}{3} + \frac{1}{3}</math> @ 100 mL/hr.</li> </ul>	<ul style="list-style-type: none"> <li>1 day of higher than normal ostomy output. Monitor on day 4 (i.e. may not require immediate attention as it is a new ileostomy – wait to see if outputs decrease).</li> <li>High ostomy output education (soluble fibre).</li> <li>Consider adding Metamucil to diet while in hospital, if high outputs continue.</li> </ul>
<p><b>Malnutrition</b></p>	<ul style="list-style-type: none"> <li>Only three days since initiation – no need for evaluation at this time.</li> <li>Fatigue and appetite seems to be improving (patient report).</li> </ul>	<ul style="list-style-type: none"> <li>Emphasize ‘making the most’ out of moments when Sam feels hungry and energized. These moments should be used to improve nutrition.</li> </ul>
<p><b>Abnormal Electrolytes</b></p>	<ul style="list-style-type: none"> <li>Electrolytes have been normal over the past three days.</li> </ul>	<ul style="list-style-type: none"> <li>Continue to monitor (while in hospital).</li> <li>Liaise with team regarding replacements, if necessary (in light of recent high output – risk of greater losses).</li> </ul>

<p><b>Education</b></p>	<ul style="list-style-type: none"> <li>• You provided Sam education (and handouts to take home) on day 2.</li> <li>• Sam does not have any questions today about the education and feels confident about the plan.</li> </ul>	<ul style="list-style-type: none"> <li>• Check in once more with Sam on his nutrition education prior to being discharged (if possible).</li> </ul>
<p><b>Medical Care Plan</b></p>	<ul style="list-style-type: none"> <li>• No changes to medical care plan-appears to be tolerating well and ostomy is actively functioning.</li> <li>• Monitor and prepare for discharge home on day 5.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue to monitor patient until he is discharged.</li> </ul>

# The Nutrition Care Process Model

As you use the Nutrition Care Process Model and the learning from this case study as a guide throughout your patient care in practicum, please keep in mind that the process is dynamic, and not step-by-step as all cases are different. You are encouraged to complete the recommended readings for this module and continue to expand your learning in this clinical area of practice.

PART 4: EVALUATE COMPLETE. Pause to reflect on the evaluation strategies discussed, and review the readings and resources in the following section for your information.

You've now completed the nutrition for Inpatient GI module. Please consider providing feedback through the embedded form in the next section.

## Acknowledgements

Cristina Gandolfi, MSc, RD

Michaela Kucab, MHSc, RD

# Feedback Form



*One or more interactive elements has been excluded  
from this version of the text. You can view them online*

here: [https://pressbooks.library.torontomu.ca/  
dietmods/?p=2250](https://pressbooks.library.torontomu.ca/dietmods/?p=2250)

# Reading List

The following is a list of readings and resources to help supplement your learning in this module topic.

## Readings

- Shah, Neha D., Limketkai, Berkeley N. (2015). [Low residue vs. low fibre diets in inflammatory bowel disease: Evidence to support vs. habit?](#) *Practical Gastroenterology, Nutrition Issues in Gastroenterology, Series #143.*
- Sherf Dagan S, Goldenshluger A, Globus I, et al. [Nutritional Recommendations for Adult Bariatric Surgery Patients: Clinical Practice.](#) *Adv Nutr.* 2017;8(2):382-394. Published 2017 Mar 15. doi:10.3945/an.116.014258
- Ukleja, Andrew. (2006). [Dumping Syndrome.](#) *Practical Gastroenterology, Nutrition Issues in Gastroenterology, Series #35.* p32-46. <https://med.virginia.edu/ginutrition/wp-content/uploads/sites/199/2015/11/UklejaArticle-Feb-06.pdf>

## Additional Resources

- Alberta Health Services – Patient Education:
  - [Eating Well After Colostomy Surgery](#)
  - [Eating Well After Ileostomy Surgery](#)
- [Video – Nutrition Focused Physical Exam](#)

# References

1. Arvanitakis M, Ockenga J, Bezmarevic M, et al. *ESPEN guideline on clinical nutrition in acute and chronic pancreatitis*. *Clinical Nutrition* 39 (2020) 612-631. doi:10.1016/j.clnu.2020.01.004
2. Bischoff SC, Escher J, Hébuterne X, et al. *ESPEN practical guideline Clinical Nutrition in inflammatory bowel disease*. *Clinical Nutrition* 39 (2020) 632-653. doi:10.1016/j.clnu.2019.11.002
3. Diabetes Canada Clinical Practice Guidelines Expert Committee. *Diabetes Canada 2018 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada*. *Can J Diabetes*. 2018;42(Suppl 1):S1-S325.
4. *Essential Guide for Renal Dietitians 4th edition*. 2020 Canadian Association of Nephrology Dietitians.
5. Ikizler TA, Burrowes JD, Byham-Gray LD, et al. *KDOQI Clinical Practice Guideline for Nutrition in CKD*. *Am J Kidney Dis*. 2020;76(3 Suppl 1):S1-S107. doi:10.1053/j.ajkd.2020.05.006
6. *Kidney Disease: Improving Global Outcomes (KDIGO) CKD-MBD Update Work Group. KDIGO 2017 Clinical Practice Guideline Update for the Diagnosis, Evaluation, Prevention, and Treatment of Chronic Kidney Disease—Mineral and Bone Disorder (CKD-MBD)*. *Kidney Int Suppl*. 2017;7:1-5
7. *Kidney Disease: Improving Global Outcomes (KDIGO) Diabetes Work Group. KDIGO 2020 Clinical Practice Guideline for Diabetes Management in Chronic Kidney Disease*. *Kidney Int*. 2020;98(4S):S1-S115
8. Kopple JD, Massry SG, Kalantar-Zadeh K. *Nutritional Management of Renal Disease, 3rd edition*. Elsevier, San Diego, 2013
9. Pearson GJ, Thanassoulis G, Anderson TJ, et al. *2021 Canadian Cardiovascular Society Guidelines for the Management of Dyslipidemia for the Prevention of Cardiovascular Disease in*

Adults. *Canadian Journal of Cardiology* 37(8) p1129-1150, Aug 01 2021. doi:10.1016/j.cjca.2021.03.016

10. Singer P, Blaser AR, Berger MM, et al. *ESPEN guideline on clinical nutrition in the intensive care unit*. *Clinical Nutrition* 38 (2019) 48-79. doi:10.1016/j.clnu.2018.08.037
11. Sunnybrook Health Sciences Centre Registered Dietitians. (2017). [Clinical Nutrition Resource Handbook](#). Sunnybrook Health Sciences Centre.