

### Renal

Applicable to: Nurses, Physicians and Other Health Professionals

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## Summary of Key Recommendations

- Nutrition care for patients with chronic kidney disease (CKD) should be individualized taking into account the patient's individual needs, stage of kidney disease, nutritional status, and comorbid conditions.
- Multiple factors can attribute to the increased risk of protein-energy wasting (PEW) or malnutrition in individuals with CKD.
- Routine assessment of nutritional status at least biannually is suggested to prevent and/or treat malnutrition and wasting in individuals with CKD 3–5D.
- Adequate calories are required to prevent catabolism or PEW in adult patients with CKD.
- Protein requirements can be highly variable and require individual assessment by a registered dietitian (RD). A stepwise, individualized approach is recommended. Initial education on a moderate-protein diet (0.8–1.0 g protein/kg body weight/day) (best practice) may be beneficial for some patients. Under close clinical supervision by an RD, protein may be further reduced in metabolically stable individuals with CKD stages 3–5 without diabetes. Referral to an RD for nutrition counselling is recommended before changes to protein intake are made.
- Protein recommendations should be individualized and based on patient preference for animal or plant-based protein.
- It is recommended serum potassium be regularly monitored, and patients receive education regarding dietary potassium restriction once serum potassium levels are elevated (> 5.5 mmol/L, depending on the clinic/physician preference). Referral to an RD for nutrition counselling is recommended for patients requiring a potassium restricted diet.
- Unless otherwise directed by the patient's physician, total fluid intake for patients with CKD does not need to be restricted.
- The recommended daily sodium intake is < 100 mmol (< 2300 mg) for individuals with CKD stages 3–5 and on dialysis. For patients with hypertension, the recommended daily sodium intake is 65–100 mmol (1495–2300 mg) in addition to antihypertensive medications and/or diuretics to control blood pressure (BP) and proteinuria.
- General multivitamins are not recommended in individuals with CKD due to their vitamin A content. Supplementation of vitamin A is also discouraged.
- Referral to an RD is recommended for patients with declining kidney function to ensure nutritional adequacy and reduce nutrition risk.



# Nutrition Guideline

## Renal

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### Introduction

The purpose of the Renal Nutrition Guideline is to provide health professionals with an overview of the evidence-based nutrition recommendations for adults with chronic kidney disease and provide answers to commonly asked questions (See [Key Questions List](#)).

The Nutrition Guideline was developed by the Provincial Renal Nutrition Practice Working Group and is based on scientific evidence and best practice. It was reviewed by stakeholders across the province including the Kidney Health Section Committee of the Medicine SCN. If you have questions about this Nutrition Guideline, please contact [Nutrition\\_Resources@ahs.ca](mailto:Nutrition_Resources@ahs.ca).

This information is intended as a general resource only and is not meant to replace the medical counsel of a physician or individual consultation with an RD. It is the responsibility of health professionals to evaluate the situation of each patient in their care, and apply the Nutrition Guideline appropriately. Individuals who are at high risk of malnutrition or who have a medical condition that is impacted by nutrition should be referred to an RD.

### Referral to a Registered Dietitian

For more information on referral to an RD and RD services available in Alberta Health Services (AHS):

- See Nutrition Guideline: [Referral to a Registered Dietitian](#)
- Visit [Referring Patients for Nutrition Services](#)

Note: For purposes of this Nutrition Guideline, the single term patient will be used to refer to clients, patients, and residents.

### Key Questions List

Key nutrition questions related to chronic kidney disease that are addressed in this Nutrition Guideline are listed below.

#### Definitions and Diagnosis

- What is chronic kidney disease?
- How is chronic kidney disease diagnosed?

#### Factors affecting Kidney Function

- How does body weight affect kidney function?
- How does glycemic control affect kidney function?
- What effect does blood pressure have on kidney function?

#### Role of Registered Dietitians in Chronic Kidney Disease

- How can an RD support an individual with chronic kidney disease?

# Nutrition Guideline

## Renal

---

### Malnutrition

- Are individuals with chronic kidney disease at increased risk of malnutrition?

### Protein Recommendations

- What are the protein needs of individuals with chronic kidney disease?
- What type of protein is recommended for individuals with chronic kidney disease?

### Potassium Recommendations

- Do individuals with chronic kidney disease need a potassium restriction?
- How much potassium is recommended on a potassium-restricted diet?
- When are potassium binding resins prescribed for individuals with kidney disease?

### Sodium Recommendations

- Do individuals with chronic kidney disease need a sodium restriction?
- Is the DASH Diet Recommended for individuals with chronic kidney disease and hypertension?

### Phosphorus Recommendations

- Do individuals with chronic kidney disease need a phosphorus restriction?
- When are phosphorus binders prescribed for individuals with kidney disease?

### Dietary Supplements

- What vitamins and minerals are not recommended for an individual with chronic kidney disease?
- Are individuals with chronic kidney disease at increased risk for vitamin or mineral deficiencies?
- Are iron supplements recommended for individuals with chronic kidney disease?
- Which nutrition supplements could be recommended for someone with chronic kidney disease?
- Are probiotics recommended for individuals with chronic kidney disease?

### Fluid and Fibre Recommendations

- Do individuals with chronic kidney disease require a fluid restriction?
- What is the recommended daily intake of fibre for an individual with chronic kidney disease?

### Heart Health Recommendations

- Do individuals with chronic kidney disease need a low cholesterol diet?

# Nutrition Guideline

## Renal

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### Renal Replacement Therapies

- When do individuals with chronic kidney disease start renal replacement therapies and what are the treatment options?
- Do nutrient requirements differ for individuals with chronic kidney disease on renal replacement therapies?
- Are individuals on dialysis at higher risk of malnutrition?
- Do individuals on dialysis require a fluid restriction?
- Is it safe for individuals on hemodialysis to eat during dialysis sessions?
- If individuals cannot attend hemodialysis sessions due to an emergency or natural disaster what diet recommendations should they follow?
- Are additional calories absorbed from glucose solutions during peritoneal dialysis?

### Other Important Considerations

- What are other important considerations for patients with chronic kidney disease?

### Resources

- Are there additional resources available for patients with chronic kidney disease?
- Are there additional resources available for health professionals providing care for patients with chronic kidney disease?

### Answers to Key Questions

#### Definitions

Return to [Key Questions List](#)

#### What is chronic kidney disease?

Chronic kidney disease (CKD) is defined as a variety of abnormalities of kidney structure or function that impact health, and are present for > 3 months.<sup>1</sup> Kidney disease can range from mild to severe and in some cases lead to end-stage kidney disease or kidney failure (see Table 1 below). End-stage kidney disease treatment options include different forms of dialysis, transplantation or non-dialysis supportive care (conservative kidney management).<sup>2</sup>

There are multiple causes of CKD including:

- glomerular diseases (such as diabetes, glomerulonephritis, amyloidosis)
- tubulointerstitial diseases (such as urinary tract infections/obstructions and recurrent kidney stones, obstructions)
- vascular diseases (such as hypertension)
- cystic and congenital diseases (such as polycystic kidney disease, Alport syndrome, and Fabry disease)<sup>1</sup>

#### How is chronic kidney disease diagnosed?

The National Kidney Foundation's Kidney Disease Outcomes Quality Initiative (K/DOQI) clinical practice guidelines classify CKD based on cause, estimated glomerular filtration rate (GFR) that is calculated from the serum creatinine level and albuminuria category (see Table 1 and 2).<sup>1</sup>

**Table 1. Stages of Chronic Kidney Disease of All Types Based on Glomerular Filtration Rate (GFR)<sup>1</sup>**

Stage	Description	Renal Function (GFR) mL/min per 1.73 m <sup>2</sup>
1	Normal or high GFR	≥ 90
2	Mildly decreased GFR	60–89
3A	Mild to moderately decreased GFR	45–59
3B	Moderate to severely decreased GFR	30–44
4	Severe decreased GFR	15–29
5	End-stage renal disease (ESRD)–kidney failure	< 15
5D	Individuals treated by dialysis	

A user-friendly GFR calculation is available online at:  
[www.kidney.org/professionals/kdoqi/gfr\\_calculator.cfm](http://www.kidney.org/professionals/kdoqi/gfr_calculator.cfm)

# Nutrition Guideline

## Renal

Table 2. Categories of Albuminuria in Chronic Kidney Disease<sup>1</sup>

Category	Albumin Excretion Rate (AER) mg/24 hours	Albumin-to-Creatinine Ratio (ACR) (approximate equivalent)		Description
		mg/mmol	mg/g	
A1	< 30	< 3	< 30	Normal to mildly increased
A2	30–300	3–30	30–300	Moderately increased*
A3	> 300	> 30	> 300	Severely increased **

\* Relative to young adult level.

\*\* Including nephrotic syndrome (albumin excretion usually 2200mg/24 hours [ACR >2220mg/g; >220 mg/mmol]).

## Factors Affecting Kidney Function

Return to [Key Questions List](#)

### How does body weight affect kidney function?

Obesity (defined by body mass index [BMI] > 30 kg/m<sup>2</sup>) is an independent risk factor for CKD and is also associated with other risk factors for CKD such as diabetes and hypertension. Modest weight loss in individuals with obesity can decrease the metabolic demands on the kidney.<sup>3</sup> Additional benefits of intentional weight loss in individuals with obesity with mild to moderate kidney disease may include a reduction in urinary albumin excretion and improvement in blood pressure.<sup>4,5</sup> Weight loss in individuals with CKD with a BMI > 25 kg/m<sup>2</sup> is also associated with decreased proteinuria; however, there is insufficient evidence evaluating the effect of this decrease on CKD progression.<sup>6</sup>

It is recommended health care professionals assess an individual's interest in weight management and recommend lifestyle interventions for individuals with diabetes mellitus and CKD if BMI > 30 kg/m<sup>2</sup> particularly when GFR ≥ 30 mL/min per 1.73 m<sup>2</sup>.<sup>7</sup>

### Considerations

- Obesity treatment recommendations should be individualized.
- Weight loss may not be appropriate for individuals with advanced CKD (GFR < 30 mL/min per 1.73 m<sup>2</sup>) who may be at increased risk of unintentional weight loss and malnutrition.<sup>7</sup>
- Evidence suggests individuals with higher BMIs on dialysis have a lower mortality risk.<sup>8</sup>

For more information on obesity treatment options including behavioural intervention, medication, and bariatric surgery, please refer to the following Nutrition Guideline: [Adult Obesity Care](#).

### How does glycemic control affect kidney function?

CKD is a common co-morbidity for individuals with diabetes. Persistent hyperglycemia can cause permanent damage to the nephron. The duration of diabetes in patients with both type 1 and type 2 diabetes is another risk factor in the development of nephropathy. The most common form of CKD in diabetes is diabetic nephropathy. Intensive glycemic management and optimization of blood pressure can reduce and slow the development and progression of renal damage. Intensive diabetes management is recommended as early and safely as possible in patients with CKD and diabetes using a collaborative health care team approach.<sup>7,9</sup>

# Nutrition Guideline

## Renal

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### Hypoglycemia

Patients with estimated GFR (eGFR) < 60 mL/min per 1.73 m<sup>2</sup> are at higher risk of hypoglycemia.<sup>10</sup> There are many different reasons for this, including the prolonged action of certain oral hypoglycemic agents (sulfonylureas and insulin), a decrease of gluconeogenic precursors (including lactate and amino acids) as kidney function declines, and if consumed, the influence of alcohol on blood glucose levels. Patients with CKD and diabetes need to be aware of CKD-friendly methods of treating hypoglycemia.

### Hemoglobin A1c

A target hemoglobin A1c (HbA1c) for individuals with diabetes and kidney disease of less than 7.0% is recommended for renal protection. A range of 7.1–8.5% may be considered for individuals with advanced kidney disease with limited life expectancy and conservative kidney management for frail elderly.<sup>11</sup> The measurement of HgA1C in individuals with CKD is less precise than in individuals who do not have CKD. It can be influenced by multiple factors including the erythropoiesis-stimulating agent (which can cause rapid changes in hemoglobin concentrations), anemia, blood transfusions, and acid-base balance. The accuracy and precision of HbA1c measurements further declines with advanced CKD 4–5, especially in individuals on dialysis.<sup>10,11</sup>

For more information, please refer to the following Nutrition Guideline: [Adult Diabetes](#).

### What effect does blood pressure have on kidney function?

Hypertension is one of the major risk factors for the development of kidney disease and cardiovascular disease (CVD). Lifestyle, as well as pharmacological agents, are recommended to reduce blood pressure in individuals with CKD.<sup>12</sup> The goals of antihypertensive therapy in CKD are to lower blood pressure to reduce the risk of CVD and to slow the progression of CKD.<sup>12,13</sup>

Hypertension is both a cause and complication of CKD.<sup>12,13</sup> Arterial hypertension is a key risk factor for kidney damage in people with type 2 diabetes.<sup>14</sup> Several trials have shown that intensive treatment of elevated blood pressure (particularly systolic blood pressure) lowers the risk of microvascular disease, CVD and mortality.<sup>14</sup> Regular use of a home blood pressure monitor is recommended regularly for patients with hypertension and CKD [Grade C].<sup>15</sup>

### Blood Pressure Targets

Blood pressure targets should be individualized for patients with hypertension and CKD (see Table 3). Intensive blood pressure targets such as a systolic blood pressure <120 mmHg may be considered in some patients with increased CVD risk.<sup>15</sup>

# Nutrition Guideline

## Renal

**Table 3. Recommended Blood Pressure Targets<sup>15,16</sup>**

Individuals	Blood Pressure Targets
Individuals with diabetes	Systolic blood pressure < 130 mmHg Diastolic blood pressure < 80 mmHg
Non-diabetic CKD, less than 50 years old, with increased CVD risk and current blood pressure of 130–180 mmHg and GFR < 60 mL/min per 1.73 m <sup>2</sup> (criteria based on the Systolic Blood Pressure Intervention Trial [SPRINT])	Systolic blood pressure < 120 mmHg
Individuals with polycystic kidney disease	Systolic blood pressure < 110 mmHg
All other individuals with non-diabetic CKD	Systolic blood pressure < 140 mmHg
Individuals over 80 years old	Systolic blood pressure < 150 mmHg

For more information on hypertension treatment options including medications, please refer to the following Nutrition Guideline: [Hypertension](#).

## Role of Registered Dietitians in Chronic Kidney Disease

[Return to Key Questions List](#)

### How can a registered dietitian support an individual with chronic kidney disease?

RDs play an important role in the management of CKD and can provide tailored nutrition interventions by taking into account the patient's individual needs, stage of kidney disease, nutritional status, and comorbid conditions. Beneficial outcomes of nutrition assessment and intervention for individuals with CKD:

- Decreasing the progression of renal failure or delaying the onset of renal replacement therapy.<sup>17</sup>
- Prevention or management of protein-energy wasting or malnutrition.<sup>7,18</sup>
- Correction of imbalances in calcium, phosphorus, and vitamin D metabolism in CKD.<sup>17,19</sup>
- Correction of acid-base balance.
- Correction of electrolyte and/or fluid imbalances associated with hypertension, edema, congestive heart failure or hyperkalemia.<sup>18</sup>
- Prevention or management of dyslipidemia and abnormal carbohydrate metabolism that can increase the risk of cardiovascular disease.<sup>19,20</sup>
- Opportunity to provide individualized nutrition recommendations on increasing fruit and vegetable intake for individuals with CKD 1–4 which may decrease body weight (consideration for individuals carrying excess weight), blood pressure and net acid production.<sup>7</sup>
- Consideration of nutritional implications of other comorbid conditions.



# Nutrition Guideline

## Renal

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### Malnutrition

[Return to Key Questions List](#)

#### Are individuals with chronic kidney disease at increased risk of malnutrition?

Yes. Multiple factors can attribute to the increased risk of protein-energy wasting (PEW) or malnutrition in individuals with CKD such as:

- biochemical disturbances like metabolic acidosis
- lack of appetite/intake due to uremic toxicity
- reduced energy and protein intake resulting from anorexia and dietary restrictions
- inflammation

Individuals with CKD are at higher risk of developing sarcopenia which may contribute to adverse outcomes.<sup>7</sup> Individuals with CKD 1–5 with a BMI < 18.5 kg/m<sup>2</sup> may be at increased mortality risk.<sup>8</sup>

Nutritional needs change throughout the stages of CKD; therefore, routine assessment of nutritional status by an RD is suggested at least biannually to prevent and/or treat malnutrition and wasting in individuals with CKD 3–5D.<sup>8</sup> Comprehensive nutrition assessments performed by an RD are recommended as at this time there is limited evidence to suggest a particular nutrition screening tool for identifying individuals at risk of PEW.<sup>8</sup> RDs can assist with the prevention of malnutrition as a result of poor intake and provide suggestions that will assist the patient with meeting their specific nutritional needs, based on the stage of their kidney disease.

For more information, including recommendations for assessing the nutrition status of patients on dialysis, refer to the question [Are individuals on dialysis at higher risk of malnutrition?](#)

### Protein Recommendations

[Return to Key Questions List](#)

#### What are the protein needs of individuals with chronic kidney disease?

Reducing protein intake may reduce uremia and uremic toxins and improve renal hemodynamics reducing one's clinical symptoms and postponing the need to start dialysis treatments.<sup>8</sup> Using a stepwise approach, initial instruction on a moderate-protein diet (0.8–1.0 g protein/kg healthy body weight/day) (best practice) may be beneficial for some patients. Under close clinical supervision by an RD using an individualized, stepwise approach, some metabolically stable individuals with CKD stages 3–5 without diabetes may benefit from a low protein diet providing 0.55–0.6 g protein/kg body weight/day to reduce the risk of progression of CKD/death and improve quality of life.<sup>8</sup>

Protein impacts the generation of nitrogenous wastes and inorganic ions, which can cause many of the clinical and metabolic disturbances characterized in uremia. However, assessment of dietary protein intake in CKD is a balance of providing adequate protein (and calories) to meet nutritional requirements/maintain lean body mass, while preventing the complications associated with uremia, hyperphosphatemia, metabolic acidosis, and other metabolic disturbances associated with CKD.<sup>21</sup>

# Nutrition Guideline

## Renal

---

Protein requirements can be highly variable and require individual assessment by an RD. Adjustment of the protein prescription to meet the current protein requirements should be based on the individual's health, stage of kidney disease, life stage, level of physical activity, metabolic stressors (e.g. presence of wounds and/or infection), and goals of care (promote healthy body weight, prevent protein-energy wasting). Assessment of optimal energy intake to prevent lean body mass losses/muscle catabolism should also be considered.<sup>22</sup>

### What type of protein is recommended for individuals with chronic kidney disease?

Current guidelines suggest there is insufficient evidence to recommend a protein type (i.e. plant vs. animal) in terms of the effects of nutritional status in individuals with CKD 1–5D.<sup>8</sup> Protein recommendations should be individualized and based on patient preference for animal or plant-based protein.

## Potassium Recommendations

[Return to Key Questions List](#)

### Do individuals with chronic kidney disease need a potassium restriction?

Patients with CKD may be unable to maintain potassium homeostasis and are at a higher risk for hyperkalemia. This may be due to decreased potassium excretion by the kidneys or increased potassium retention due to certain medications. Angiotensin-converting-enzyme (ACE) inhibitors and angiotensin-receptor blockers (ARBs) tend to cause potassium retention, whereas diuretics such as furosemide tend to cause potassium to be lost.

Before adjusting dietary potassium intake, health professionals are encouraged to identify non-dietary factors influencing serum potassium levels such as medications, glycemic control, hydration status, kidney function or gastrointestinal problems (e.g. vomiting, diarrhea, constipation, and bleeding) and correct them as able.<sup>8</sup>

It is recommended patients receive education regarding dietary potassium restriction once serum potassium levels are elevated (over 5.5 mmol/L, depending on the clinic/physician preference). Patients with hypokalemia or low serum potassium levels (< 3.5 mmol/L) should receive dietary instruction regarding increasing potassium intake.

It is recommended patient education include information on label reading for potassium food additives, foods containing high amounts of potassium, low potassium alternatives, cooking methods, and appropriate serving sizes.

### How much potassium is recommended on a potassium-restricted diet?

Individual potassium requirements are determined based on dietary potassium intake, patient size (i.e. larger body size would have larger potassium requirements), urine output/stage of kidney disease, medications such as spironolactone, ACE inhibitors, and ARBs, and presence/treatment of metabolic acidosis.<sup>22</sup> However, recent guidelines highlight there are gaps in the literature regarding dietary potassium recommendations for individuals with CKD. Further research is required to determine optimal dietary potassium intake in different stages of kidney disease as well as how dietary potassium influences blood content (serum levels) and clinical outcomes.<sup>8</sup> Table 4 provides best practice nutrition recommendations based on serum potassium levels. Individual potassium requirements are to be used as a starting point only and should be refined with the evaluation of laboratory values and clinical judgement.

# Nutrition Guideline

## Renal

**Table 4. General Nutrition Recommendations based on Serum Potassium Level**

Serum Potassium	Best Practice Recommendations
5.5–5.9 mmol/L	1 mmol of potassium per kg healthy body weight (HBW) (HBW based on BMI reference ranges based on age) to establish appropriate daily dietary potassium restriction.
>5.9 mmol/L	Further adjustments to the potassium restricted diet guidelines above may include: providing 4–5 low potassium fruit/vegetable choices (with no high potassium fruit/vegetable choices), and avoiding, rather than limiting, foods made with whole bran.

Patients requiring a potassium restricted diet should be referred to an RD. It is recommended patient education include information on label reading for potassium food additives, foods containing high amounts of potassium, low potassium alternatives, cooking methods, and serving sizes.

### When are potassium binding resins prescribed for individuals with kidney disease?

Potassium binding resins (e.g. sodium polystyrene sulphate [Kayexalate<sup>®</sup>], sodium zirconium cyclosilicate [Lokelma<sup>®</sup>] or patiomer sorbitex calcium [Veltassa<sup>®</sup>]) may be used in cases where hyperkalemia persists, despite dietary strategies to lower serum potassium. Larger doses of potassium binding resins can have gastrointestinal side effects including nausea, vomiting, anorexia, or constipation. It has been hypothesized the use of potassium binding resins could allow for a more liberalized potassium diet however, this has not been well studied.<sup>8</sup>

## Sodium Recommendations

[Return to Key Questions List](#)

### Do individuals with chronic kidney disease need a sodium restriction?

In individuals with CKD, water retention due to sodium retention can further aggravate pre-existing hypertension.<sup>22</sup> Hypertension increases cardiovascular risk and further renal damage. Reduction in sodium intake will reduce water retention, which will, in turn, reduce hypertension.

It is recommended that all adults (with or without CKD) reduce their dietary sodium intake to prevent hypertension. Dietary sodium should be restricted to less than 2300 mg/day (< 100 mmol/day) in addition to a well-balanced diet to prevent hypertension and improve volume control.<sup>8,13,22,23</sup> For patients with hypertension, the recommended daily sodium intake is 1495–2300 mg (65–100 mmol/day) in addition to antihypertensive medications and/or diuretics to control blood pressure (BP) and proteinuria.<sup>23</sup>

Restricting sodium intake to < 1500 mg (approximately 65 mmol/day) may be difficult for some patients; therefore, it is recommended that patients aim for the lowest sodium diet/intake possible.<sup>23</sup>

The primary focus of a sodium-restricted diet (< 2300 mg) is to limit high sodium foods (including foods with sodium additives) and to promote lower sodium cooking methods (where applicable). Patients with CKD requiring a sodium-restricted diet should be referred to an RD for nutrition counselling.

# Nutrition Guideline

## Renal

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### Salt Substitutes

It is advised individuals with CKD avoid salt substitutes (e.g. No-Salt<sup>®</sup>, Half-Salt<sup>®</sup>) and sodium-reduced foods (e.g. low sodium soups) that contain potassium additives such as potassium chloride which are used in place of sodium chloride (salt).

For more information, please refer to the following Nutrition Guidelines: [Hypertension](#) and [Sodium](#).

### Is the Dietary Approaches to Stop Hypertension (DASH) Diet Recommended for individuals with chronic kidney disease and hypertension?

The Dietary Approaches to Stop Hypertension (DASH) diet has been promoted as a therapy for patients with hypertension.<sup>24,25</sup> The safety and acceptability of a DASH dietary pattern should be determined on an individual basis in advanced stages of kidney disease. Health professionals are encouraged to consider a patient's serum potassium control and adequacy of protein and energy intake when determining its safety and applicability.<sup>8</sup> Referral to an RD is recommended to support patients considering implementing this dietary pattern.

### Phosphorus Recommendations

[Return to Key Questions List](#)

### Do individuals with chronic kidney disease need a phosphorus restriction?

Serum phosphate levels rise in CKD due to a decreased capacity to excrete phosphorus via the kidneys. High serum phosphate levels:

- Contribute to the development of secondary hyperparathyroidism in patients with CKD.
- Increase the risk of renal bone disease and soft tissue calcification (due to calcium-phosphorus deposition).
- Have been associated with increased mortality in patients with CKD/ESRD.<sup>21</sup>

Correction and prevention of hyperphosphatemia is a key component of the management of CKD. For individuals with CKD 3–5D it is recommended dietary phosphorus intake be adjusted in order to maintain serum phosphate levels within the normal range.<sup>8</sup> It is advised patients receive education regarding dietary phosphorus restriction once serum phosphate levels are elevated. It is important to consider the bioavailability of phosphorus sources in the diet. Initial dietary education on phosphorus restriction should focus on limiting sources of inorganic phosphorus, which includes phosphorus compounds that are added to foods during processing (such as phosphoric acid, polyphosphate, and pyrophosphates) and are absorbed at a rate of greater than 90%. In comparison, the rate of intestinal absorption of organic phosphorus is around 20–40% for plant-based foods and 40–60% for animal-based foods.<sup>26</sup>

Patients following a phosphorus-restricted diet can be at increased risk for protein-energy malnutrition. Nutrition education is recommended by an RD to help balance the phosphorus restriction along with other renal dietary restrictions including potassium and protein.

# Nutrition Guideline

## Renal

### When are phosphorus binders prescribed for individuals with kidney disease?

Phosphorus or phosphate binders bind phosphorus in the gut reducing intestinal absorption. Phosphorus binders are often calcium-based (e.g. calcium carbonate) or non-calcium-based (e.g. sevelamer hydrochloride [Renagel<sup>®</sup>] or sucroferric oxyhydroxide [Velphoro<sup>®</sup>]) and may be used when hyperphosphatemia persists, despite dietary strategies to lower serum phosphate. As CKD progresses, individuals will often require some form of a phosphorus binder to control serum phosphate levels. Dietary education remains an essential part of the intervention to address and adjust appropriate phosphorus binder doses, based on the phosphorus content of meals and snacks.<sup>21</sup>

### Dietary Supplements

[Return to Key Questions List](#)

### What vitamins and minerals are not recommended for an individual with kidney disease?

General multivitamins are not recommended for patients with CKD. At this time, there is no safety data on the use of a regular multivitamin/mineral supplement for patients with CKD. Many provide higher doses of vitamins A, E, and K than are recommended for individuals with CKD stages 4–5.

**Table 5. Vitamin and Mineral Recommendations for Chronic Kidney Disease**

Vitamin/Mineral	Recommendations
Vitamin A	<ul style="list-style-type: none"><li>• There is no safety data regarding supplementation of vitamin A in patients with CKD.<ul style="list-style-type: none"><li>◦ Due to lack of evidence, there are no recommendations regarding vitamin A supplementation for individuals with CKD 1–5. An individualized approach is suggested to determine the need for supplementation.</li><li>◦ Supplementation of vitamin A is not recommended in individuals on dialysis given the potential for vitamin toxicity.<sup>8</sup></li></ul></li></ul>
Vitamin E	<ul style="list-style-type: none"><li>• Optimal serum vitamin E levels have not been defined for individuals with CKD. The optimal daily intake of vitamin E required to maintain nutritional health, reverse deficiency and avoid toxicity in CKD populations is also unclear.<ul style="list-style-type: none"><li>◦ Due to limited evidence, there are no recommendations regarding vitamin E supplementation for individuals with CKD 1–5.</li><li>◦ Assessment of an individual's nutritional status, dietary intake, medications, and comorbid conditions particularly baseline CVD and lipid levels is suggested to determine the need for supplementation. Doses <math>\geq</math> 400 IU/day are not recommended without intermittent monitoring of serum vitamin E levels.<sup>8</sup></li><li>◦ Supplementation of vitamin E is not recommended in individuals on dialysis given the potential for vitamin toxicity.<sup>8</sup></li></ul></li></ul>
Vitamin K	<ul style="list-style-type: none"><li>• There is no evidence to show the benefit or risk of vitamin K supplementation in individuals with CKD, therefore no recommendations regarding safe amounts are available.</li></ul>

# Nutrition Guideline

## Renal

Vitamin/Mineral	Recommendations
Vitamin D	<ul style="list-style-type: none"><li>• There is a significant lack of consensus over vitamin D measurement, monitoring, and therapy in the CKD population.</li><li>• Recent guidelines suggest vitamin D supplementation in the form of cholecalciferol (D<sub>3</sub>) or ergocalciferol (D<sub>2</sub>) be provided to correct 25(OH)D deficiency/insufficiency in individuals with CKD including those on dialysis.<sup>8</sup></li><li>• Supplementation strategies used in the general population are recommended.</li><li>• For example, If 25(OH) vitamin D deficiency is suspected, in consultation with a nephrologist, consider supplementing 1000 IU vitamin D<sub>3</sub> (cholecalciferol) daily (best practice).</li></ul>
Vitamin C	<ul style="list-style-type: none"><li>• High dose vitamin C supplementation (500 mg/day) has been shown to increase serum oxalate levels<sup>8</sup> and may increase the risk of hyper-oxalosis and associated nephrolithiasis (kidney stones).<sup>27,28</sup></li><li>• Supplementation of vitamin C above the amount in the renal multivitamin in those with a GFR &lt; 30 mL/min per 1.73 m<sup>2</sup> should be avoided.<sup>29</sup></li></ul>
High doses of B vitamins (vitamin B <sub>6</sub> , B <sub>12</sub> and folic acid)	<ul style="list-style-type: none"><li>• High doses of B vitamins may increase the progression of kidney disease and incidence of vascular events (myocardial infarction, stroke) in individuals with diabetic nephropathy not on dialysis.<sup>30</sup> In this patient population:<ul style="list-style-type: none"><li>○ High-dose B vitamin supplementation should be discouraged.<sup>30</sup></li><li>○ Patients are recommended to take Replavite® up to 2 times/week to meet, but not exceed DRIs for vitamins B<sub>6</sub>, B<sub>12</sub>, and folic acid (best practice).</li></ul></li></ul>
Aluminum	<ul style="list-style-type: none"><li>• There is a risk of aluminum toxicity in patients with ESRD due to an increased gastrointestinal uptake of aluminum.</li><li>• Citrate-based products, such as calcium citrate, appear to enhance the toxic effects of aluminum, especially in the brain.</li><li>• Citrate-based compounds should be avoided in patients with GFR &lt;30 mL/min per 1.73 m<sup>2</sup>.</li></ul>

### Are individuals with chronic kidney disease at increased risk for vitamin or mineral deficiencies?

Vitamin and trace element (mineral) adequacy in CKD can be impaired due to multiple factors such as uremia (diminished losses due to impaired excretion via the kidneys), inadequate intake, impaired absorption, and excessive losses.<sup>31</sup> Refer to Table 6 for examples of individuals with CKD who may be at higher risk of vitamin and mineral deficiencies.

Detailed food recall, food records and/or food frequencies can be used to assess dietary vitamin and mineral intake. Assessment of dietary vitamin intake should be done periodically for individuals with stages CKD 3–5D and supplementation considered when vitamin intake is found to be inadequate.<sup>8</sup>



# Nutrition Guideline

## Renal

**Table 6. Examples of Individuals with Chronic Kidney Disease that May be at Higher Risk of Vitamin and Mineral Deficiencies**

Individuals at Risk	Recommendations
Individuals not on dialysis following a protein-restricted diet (consuming < 0.75 g/kg/BW)	<ul style="list-style-type: none"><li>• May require supplementation of B vitamins (thiamin, riboflavin and vitamin B<sub>6</sub> in particular) to meet the recommended daily allowance (RDA).</li><li>• A daily renal multivitamin could be considered (such as Replavite®).<sup>22</sup></li></ul>
Individuals not on dialysis with: <ul style="list-style-type: none"><li>• inadequate nutritional intake</li><li>• frequent nausea or vomiting</li><li>• taste changes/aversion</li></ul>	<ul style="list-style-type: none"><li>• Inadequate nutritional intake is defined as eating less than 50% of meals and/or consuming less than 1500 kcal/day.</li><li>• A daily renal multivitamin could be considered (such as Replavite®) (best practice).</li></ul>
Certain CKD populations such as: <ul style="list-style-type: none"><li>• Individuals who are pregnant</li><li>• individuals post gastric bypass surgery</li><li>• individuals with malabsorption conditions</li><li>• individuals with anorexia and wasting syndrome with poor intake</li><li>• individuals following vegetarian diets</li><li>• individuals taking certain medications that may have different micronutrient needs</li></ul>	<ul style="list-style-type: none"><li>• May be at higher risk for micronutrient deficiencies.</li><li>• Supplementation of vitamins and minerals should be individualized.<sup>8</sup></li></ul>
Individuals on dialysis (renal replacement therapies)	<ul style="list-style-type: none"><li>• A daily renal multivitamin (such as Replavite®) is recommended to replace water-soluble vitamin losses through dialysis especially for individuals with inadequate nutritional intake to prevent or treat micronutrient deficiencies.<sup>8</sup></li></ul>

### Are iron supplements recommended for individuals with chronic kidney disease?

Individuals with CKD are at increased risk of anemia primarily as a result of decreased erythropoietin hormone production resulting in decreased red blood cell production. Adequate iron stores are important, as iron is required to make red blood cells.

Many patients with CKD will need to take an oral iron supplement to increase their iron levels to the target range. In some cases, as GFR falls individuals may require intravenous iron supplementation. Patients will rarely be able to achieve adequate iron status with dietary iron intake alone.

As CKD progresses, patients may be put on Erythropoietin (e.g. Aranesp®) to increase hemoglobin levels. Adequate iron status is also critical to optimizing the use and effect of erythropoietin.

Patients with CKD should not be encouraged to take extra vitamin C (ascorbic acid) to improve absorption of iron in the GI tract due to current insufficient evidence of safety.<sup>32</sup>

# Nutrition Guideline

## Renal

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### Which nutrition supplements could be recommended for someone with chronic kidney disease?

People with CKD can often struggle with poor appetite and eating enough to get adequate nutrition. This is often due to uremia, but can also be due to medications, co-morbid conditions and social factors that prevent adequate nutrition.

#### Oral Nutrition Supplements

Oral nutrition supplements (ONS) may be used in individuals with CKD who are not able to meet their estimated nutrient requirements through oral intake. These supplements are available for purchase through a pharmacy or grocery store. Patients can use nutritional supplements as a meal replacement or in addition to meals and snacks to improve the consistency of nutrients and energy/protein. Whenever possible it is advised patients be encouraged to meet nutrient requirements through food intake.<sup>9,18</sup>

Commercially prepared renal-specific ONS may be preferable due to increased protein/calories and decreased potassium and phosphorus content.<sup>33</sup> Novosource Renal<sup>®</sup>, Nepro<sup>®</sup>, and Suplena<sup>®</sup> are examples of liquid renal supplements. All are available in vanilla flavour.

Patients with CKD may not require a “renal specific” formulation. If the patient does not require potassium, phosphorus, and/or fluid restriction, the patient may benefit from a trial of a non-renal ONS which may provide other benefits (e.g., increased range of flavours, or a specific price point).

#### Protein Powder

Patients that have difficulty meeting protein requirements may benefit from the use of a protein powder. Not all protein powders are created equal, so it is important that the protein powder be reviewed by an RD for potassium, phosphorus, and sodium content to determine if it is appropriate for a patient’s estimated requirements. Beneprotein<sup>®</sup> and Boost Just Protein<sup>®</sup> are examples of protein powders that may be appropriate for patients with CKD.

### Are probiotics recommended for individuals with kidney disease?

Multiple factors are thought to contribute to dysbiosis in individuals with CKD such as uremic toxins altering gut microbiota and the intestinal barrier, accumulation of metabolites such as uric acid, inadequate fibre due to renal diet restrictions and use of multiple medications.<sup>34</sup> Altered gut microbiota and the disruption of the intestinal barrier produce uremic toxins that may contribute to uremic toxicity and inflammation.<sup>34</sup> The use of probiotics has been hypothesized as a potential strategy to adjust the gut microbiota.

Despite increased interest in the potential benefits of probiotics and CKD, there is limited evidence to support their widespread use at this time.<sup>35</sup> There is a vast array of available probiotic strains each with a different underlying mechanism of action. Further research is required in this area.



# Nutrition Guideline

## Renal

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### Fluid and Fibre Recommendations

[Return to Key Questions List](#)

#### Do individuals with chronic kidney disease require a fluid restriction?

Progressive CKD results in reduced water clearance, which can contribute to fluid overload and hypertension, as well as subsequent cardiovascular and respiratory complications.<sup>1</sup> It is recommended fluid intake be adjusted to the clinical state of the individual, taking into account the degree of reduced GFR, edema, and hypertension management.<sup>22</sup>

Unless otherwise directed by the patient's physician, total dietary fluid intake for patients with CKD should be unrestricted.<sup>21</sup> It is not recommended for patients with CKD to "push fluids". Normal thirst guided intake should determine fluid/beverage intake unless there is a specific reason for increased fluid intake, such as salt-wasting nephropathies, history of nephrolithiasis (kidney stones), or lithium nephrotoxicity.<sup>36</sup>

A dietary sodium restriction is another key component of the management of patients with CKD. It is advised dietary strategies address excessive sodium intake (where appropriate), rather than dietary fluid restrictions, and should be prioritized in patients that are volume overloaded or are experiencing complications of comorbidities that contribute to volume excess (e.g. congestive heart failure).<sup>37,38</sup>

Patients requiring a fluid restricted diet should be referred to an RD. Specific nutrition education by an RD is essential when balancing the fluid requirements along with other renal dietary restrictions including sodium.

It is important to note that high fluid intake **may** be part of the management strategy for certain conditions such as nephrolithiasis, post-renal transplant, and urinary tract infections.<sup>22</sup>

#### What is the recommended daily intake of fibre for an individual with kidney disease?

Constipation can be a common problem for individuals with kidney disease. Constipation can be caused by a diet low in fibre, too little exercise, fluid restrictions, some medications, or stress. Adequate fibre intake provides many health benefits for patients with kidney disease, including gastrointestinal health, prevention of constipation, easier bowel movements, and the cholesterol-lowering/blood sugar controlling benefits of certain types of fibre.

Dietary fibre recommendations for the general population (14 g per 1000 kcal/day) can be difficult for patients with CKD to achieve, due to other dietary restrictions (e.g., potassium and phosphorus).<sup>39</sup> Where serum phosphate or potassium levels allow (maintained within normal range), individuals with CKD are encouraged to incorporate high-fibre and whole grain products into their diet.

Patients that are struggling with constipation and need education on appropriate high fibre, low potassium/phosphorus choices should be referred to an RD for nutrition counselling. An RD can help patients choose appropriate servings sizes and fibre supplements that do not contain too much potassium or phosphorus or require too much fluid for administration (if on a fluid restriction).

### Heart Health Recommendations

Return to [Key Questions List](#)

#### Do individuals with chronic kidney disease need a low cholesterol diet?

Cardiovascular disease is highly prevalent in the CKD population and has a major impact on morbidity and mortality. Lipid abnormalities develop during the early stages of CKD and become more pronounced with changes in proteinuria and declining GFR.<sup>9</sup> Individuals with kidney disease are encouraged to make dietary and lifestyle changes to address the cardiovascular risks associated with CKD. Following a Mediterranean diet pattern for individuals with CKD 1–5, with or without dyslipidemia, may improve lipid profiles.<sup>8</sup> There is, however, limited evidence to show that CVD risk decreases with the correction of lipid abnormalities.<sup>22</sup>

Unsaturated fats are the preferred fat in the diet.<sup>26</sup> Replacement of butter with flaxseed, canola, or olive oil, which are all rich in omega-3 fatty acids, is preferred, where possible.

Individuals with low serum total cholesterol may be at risk for malnutrition. There is a paradoxical association between low cholesterol and outcomes thought to be due to protein energy-wasting, inflammation and malnutrition.<sup>40</sup>

For more information, please refer to the following Nutrition Guideline: [Heart Health](#).

### Renal Replacement Therapies

Return to [Key Questions List](#)

#### When do individuals with chronic kidney disease start renal replacement therapies and what are the treatment options?

Clinical practice guidelines recommend individuals with kidney disease with an eGFR of < 15 mL/min per 1.73 m<sup>2</sup> be monitored closely by a nephrologist for eGFR decline and clinical indications of the need to start dialysis. It is recommended individuals with kidney disease start dialysis when they are experiencing symptoms that cannot be controlled by any other means not just when kidney function falls below a certain eGFR.<sup>41</sup>

When possible, individuals should be provided education on renal replacement therapy options before reaching ESRD to provide planning and interventions for dialysis access surgery on time.<sup>42</sup>

Modality or renal replacement therapies (RRT) (treatment) options generally include:

- Hemodialysis (HD): conventional/traditional (in-centre), intensive (in-centre nocturnal, home nocturnal, or short daily)
- Peritoneal dialysis (PD): continuous ambulatory or continuous cyclic peritoneal dialysis
- Kidney transplantation
- Conservative kidney management (conservative kidney care): includes symptom control and psychological/spiritual/end-of-life care.<sup>42</sup>

# Nutrition Guideline

## Renal

### Do nutrient requirements differ for individuals with chronic kidney disease on renal replacement therapies?

Yes, nutrition recommendations differ based on renal replacement therapies. It is recommended that patients on renal replacement therapies receive individualized nutrition therapy provided by an RD.

Nutrition therapy can prevent and treat protein-energy malnutrition, as well as mineral and electrolyte disorders, while also reducing the impact of other co-morbidities on the nutrition status of patients on dialysis.

### Are individuals on dialysis at higher risk of malnutrition?

Patients undergoing dialysis are at increased risk of PEW due to a multitude of factors such as reduced energy and protein intake from anorexia and diet restrictions, uremic toxicity, presence of comorbid conditions, possible depression, acidemia, muscle protein catabolism, inflammation, gastrointestinal dysfunction, the dialysis procedure itself and/or socioeconomic factors. This increased risk of PEW is associated with higher morbidity and mortality.<sup>8,43,44</sup>

The use of the 7-point Subjective Global Assessment (SGA) is recommended to assess the nutritional status of individuals with CKD 5D.<sup>8</sup> SGA is a tool for health professionals to assess nutritional status by examining five subjective and objective components of the medical history as well as three components of a physical exam (see Table 7).<sup>45</sup>

**Table 7. Components of SGA<sup>45</sup>**

Medical History	Physical Exam
<ul style="list-style-type: none"><li>weight change</li><li>dietary intake</li><li>gastrointestinal symptoms with nutritional impact</li><li>functional capacity</li><li>metabolic stress of the present disease</li></ul>	<ul style="list-style-type: none"><li>signs of muscle wasting</li><li>signs of fat wasting</li><li>nutrition-associated alterations in fluid balance</li></ul>

Additionally, the Malnutrition Inflammation Score (MIS) may be used to assess the nutritional status of individuals on hemodialysis.<sup>8</sup> The MIS tool is used to assess ten components of nutritional status including seven components of SGA in addition to BMI, serum albumin, and transferrin concentrations.<sup>7,46</sup>

### Do individuals on dialysis require a fluid restriction?

ESRD results in reduced water clearance (or absence of urine output in some cases), which contributes to fluid overload and hypertension in patients undergoing dialysis.

Unless otherwise noted, daily fluid intake from all fluid sources should be restricted to 24-hour urine output plus 500–1000 mL (2–4 cups).<sup>33,47</sup>

# Nutrition Guideline

## Renal

Any items that are liquid at room temperature (e.g. ice, ice cubes, ice cream and sherbet, Jell-O®, Popsicles®) should be considered in the total fluid intake. Soups (broth, broth portion of mixed soup, cream soup) should also be included in the total fluid intake. A dietary sodium restriction is also a key component of fluid management for patients on dialysis.

Patients requiring a fluid restricted diet should be referred to an RD. Specific nutrition education by an RD is essential when balancing the fluid requirements along with other renal dietary restrictions including sodium. Additionally, individuals with uncontrolled blood sugar levels may experience polydipsia (abnormally increased thirst). Improvement in glycemic control may improve polydipsia.

### Is it safe for individuals on hemodialysis to eat during dialysis sessions?

Eating meals or drinking oral nutrition supplements during hemodialysis sessions can be an effective strategy to increase total energy and protein intake for individuals who are hemodynamically stable and have no contraindications for eating during hemodialysis (see Table 8).<sup>7</sup> Eating during dialysis may not be appropriate for all individuals; therefore, recommendations should be individualized by the patient's healthcare team.

**Table 8. Associated Benefits and Possible Contraindications to Eating during Dialysis<sup>48</sup>**

Associated Benefits	Possible Contraindications
<ul style="list-style-type: none"><li>• improvements in nutritional status</li><li>• improved quality of life</li><li>• improved physical function</li></ul>	<ul style="list-style-type: none"><li>• low blood pressure (hypotension)</li><li>• frequently coughing or risk of choking</li><li>• diarrhea</li><li>• prone to stomach pain</li><li>• indigestion</li><li>• nausea or vomiting during treatment</li></ul>

### If individuals cannot attend hemodialysis sessions due to an emergency or natural disaster what diet recommendations should they follow?

Individuals on hemodialysis are encouraged to be prepared for emergencies where there is a potential to miss dialysis treatments.

Individuals on hemodialysis in Alberta Kidney Care are provided information on restricting potassium intake as well as a sample meal plan. The sample meal plan is not a substitute for dialysis. It is stricter than usual diet recommendations and aims to reduce the build-up of waste products and fluid. The meal plan aims to provide:

- 40–50 g protein
- 1500 mg sodium
- 1500 mg potassium
- < 500 mL fluid<sup>49</sup>

Individuals are encouraged to keep a three-day supply of food and water.

When deemed necessary and prescribed by the most responsible health practitioner (MRHP), patients on hemodialysis will also be provided with a prescription for a potassium lowering agent (potassium binding resin).

# Nutrition Guideline

## Renal

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### Are additional calories absorbed from glucose solutions during peritoneal dialysis?

During PD, varying concentrations of glucose (dextrose) are infused into the peritoneal cavity through a catheter. The fluid is held (dwells) within the abdomen for a period of time, before draining out. In this process, the lining of the abdomen (peritoneum) acts as a semipermeable membrane for fluid and waste products and removes them from the bloodstream.

Calories are absorbed from the PD solutions and contribute to total energy intake. The glucose (dextrose) absorption can be variable due to individual peritoneal membrane permeability characteristics that can affect treatment prescription, dextrose concentration, dwell time and number and volume of exchanges.

Icodextrin (also known as Extraneal®) is a non-glucose (dextrose) based solution. It is a polymer of glucose molecules but is absorbed more slowly from the peritoneal cavity compared to glucose. The icodextrin molecule, due to its size, does not cross the peritoneal membrane readily but may be absorbed through the lymphatic system. Calories absorbed are approximate to the patient's membrane transport type and the dwell time of the solution will influence the actual calories absorbed.

### Other Important Considerations

Return to [Key Questions List](#)

### What are other important considerations for patients with chronic kidney disease?

#### Household Food Insecurity

Household food insecurity (HFI) is defined as “an inadequate or insecure access to food because of financial constraints”;<sup>50</sup> it impacts physical, mental and social well-being. Health professionals will encounter patients living in food-insecure households, due to the high prevalence of HFI among those accessing health care.<sup>51</sup>

A recent survey administered by the Kidney Foundation of Canada and the Canadian Association of Nephrology Social Workers found Canadians on dialysis face significant financial challenges. The survey found the percentage of survey respondents who reported income below Canada's Low Income Cut-Off (LICO) was much higher than the general population. As well, 21% of the survey respondents reported going without food and or necessities in the last six months due to the financial burden of dialysis treatment.<sup>52</sup>

HFI is best addressed through income-based interventions.<sup>50,53,54</sup> Those experiencing HFI have food preparation, budgeting, and cooking skills similar to the general population.<sup>55</sup> Interventions focused on food skills do not protect people from, nor improve HFI.<sup>55</sup> Emergency food programs (e.g. food banks) may provide temporary relief.<sup>56</sup> However, these programs do not solve HFI and are inappropriate and/or inaccessible for many patients.<sup>56</sup>

Health professionals can offer better support if they are aware when patients are worried about having enough money for food and are experiencing other challenges because of financial strain.<sup>57,58</sup> Health professionals are encouraged to work with patients to develop interventions that are sensitive to financial strain.

# Nutrition Guideline

## Renal

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Key steps for health professionals include:

- Learn about financial strain, how to screen patients for poverty, and the link between poverty and poorer health through the **Identifying Financial Strain and Addressing Financial Barriers to Health Care Modules**; available on MyLearningLink for AHS staff and on CLiC for Covenant Health staff.
- Review the Nutrition Guideline: [Household Food Insecurity](#) for additional information on how to support patients experiencing HFI.
- Assist patients in accessing available income supports. The provincial directory 211 ([ab.211.ca](http://ab.211.ca)) can be used to identify financial benefits, programs, and services.

## Resources

Return to [Key Questions List](#)

### Are there additional resources available for patients with chronic kidney disease?

- RDs are part of many interdisciplinary care teams in Alberta Kidney Care (AKC) programs, Alberta Kidney Care-North (AKC-N) and Alberta Kidney Care- South (AKC-S). To learn more about dietitian services offered, visit [Nutrition Services](#).
- Nutrition handouts are available for patients on a variety of topics to help support their learning needs and nutrition goals. Visit [Nutrition Education](#) for more information.
- **Kidney Foundation of Canada** has a website dedicated to nutrition information for patients with kidney disease. Available at: [www.kidneycommunitykitchen.ca](http://www.kidneycommunitykitchen.ca).
- **Davita** has general information about kidney disease, treatment options, the renal diet and renal recipes. Available at: [www.davita.com](http://www.davita.com).

### Are there additional resources available for health professionals providing care for patients with chronic kidney disease?

- **CKD Clinical Pathway** has resources for primary care providers to aid in the diagnosis, medical management, and referral of adults with CKD. Includes a section on lifestyle management diet. Available at: [www.ckdpathway.ca](http://www.ckdpathway.ca).
- Nutrition Guidelines are available on a variety of topics to help support health professionals provide consistent, evidence-based messaging. Visit [Nutrition Guidelines](#) for more information.



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