BC Kidney Care Guideline:
Ordering, Reviewing & Follow-Up of Lab Work

FINAL DRAFT November 17, 2025

Contents

1.0 Scope

Lab work is a significant component of the management and monitoring of patients with chronic kidney disease (CKD). This guideline focuses on the **active monitoring** stage of the Kidney Care Clinic (KCC) journey (see Table 1) and provides recommendations on the ordering, review and follow-up of results. The **active monitoring** stage assumes that there are no significant abnormalities that require further testing, and the intensive testing around the time of diagnosis and implementing disease specific treatment strategies has been completed.

Table 1: Stages of KCC Journey

1	Support entry into KCC, provide kidney diagnosis and assess kidney failure risk
2	Implement disease specific treatment plan
3	Actively monitor the status of CKD and manage related complications
4	Provide education & support decision-making for treatment options for kidney failure
5	Support transition to transplant, dialysis or conservative care

This guideline **does not** apply to patients who have autosomal dominant polycystic kidney disease (ADPKD), glomerulonephritis (GN) or other specific conditions that require tailored lab testing. BCR website has samples of lab requisitions for patients who have ADPKD.

Patient-facing resources related to lab work are available on the BC Renal (BCR) website:

(a) Getting to know your Kidney Lab Work
(b) Nutrition-Related Test Resources
(c) Proteinuria
(d) Getting to Know Your Kidney Labwork (recorded session)

2.0 Recommendations & rationale

The recommendations in this guideline are based on a review of the KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease,[1] KDIGO 2025 Clinical Practice Guideline for Anemia in CKD,[2] KDIGO Commentary on the KDIGO 2017 Clinical Practice Guideline update for the Diagnosis, Evaluation, Prevention and Treatment of CKD-Mineral and Bone Disorder[3] and the experience of patients and staff and physicians working at BC Kidney Care Clinics (KCCs). For children, the KDIGO guidelines[1,2] and the recommendations from the Pediatric Renal Nutrition Taskforce[4,5,6,7] were considered.

In developing the recommendations, consideration was given to:

- Evidence on the effectiveness and utility of each test in the clinical management of kidney disease.
- Judicious use of resources, including:
  - KCC nephrologist and staff time to order and interpret tests.
  - Lab time to collect, process and interpret tests.
  - Planetary resources, including:
    - Patient transportation to the lab for testing.
    - Materials and supplies required by the lab to collect, process and interpret tests.

2.1 Ordering lab work

a) Recommendations

1. Current kidney function (eGFR) and degree of stability/risk of progression are used as the basis for determining the type and frequency of lab tests.

2. The ordering nephrologist determines the type and frequency of surveillance lab tests during the **active monitoring** stage (see Table 1) and individualizes to each patient.

   Refer to Tables 2 (adults) and 3 (children) for guidelines on ordering lab work during the active monitoring stage.

3. After an initial period of **active monitoring**, the ordering nephrologist may choose to back down the frequency for patients who prove to have stable kidney function and related lab parameters (refer to "Stable Over Time &/or Low Risk of Progression" columns on tables 2 and 3). For example, patients whose eGFR and ACR have been stable over several years, patients whose eGFR is declining at <2ml/min/year and/or those with a low risk of progression based on validated tools such as the Kidney Failure Risk Equation (KFRE).

b) Adults (18+ years)

Table 2: Guidelines on Ordering Lab Work during the Active Monitoring Stage (Adults)

GFR (mL/min/1.73²)	Stages 1 - 3 eGFR: 30 and Above		Stage 4 eGFR: 15 - 29		Stage 5 (eGFR <15) [a] &/or Unstable
	Onset of Active Monitoring &/or Higher Risk of Progression	Stable Over Time &/or Lower Risk of Progression	Onset of Active Monitoring &/or Higher Risk of Progression	Stable Over Time &/or Lower Risk of Progression	
Creatinine/eGFR, potassium, sodium, bicarb (CO_2), chloride	Q3 mos	Q6 mos	Q2 mos	Q3 mos	Q1 mo
Phosphorus			Q4 mos	Q6 mos	Q3 mos
Albumin			Q4 mos	Q6 mos	Q3 mos
Ionized calcium if available; if not, total calcium[b,c]			Q4 mos	Q6 mos	Q3 mos
Parathyroid hormone intact (iPTH)			Q4 mos	Q6 mos	Q3 mos
If diabetes, Hemoglobin A1c	Q3 mos	Q3 mos; if values stable, Q6 mos	Q4 mos	Q3 mos	Q3 mos
Hematology profile (CBC)	Q3 mos	Q6 mos	Q2 mos	Q3 mos	Q1 mo
On ESA: Hemoglobin only[d]	Q1 mo	Q1 mo	Q1 mo	Q1 mo	
On ESA: Serum ferritin, iron, TIBC, iron saturation[e]	Q3 mos	Q3 mos	Q3 mos	Q3 mos	Q 3 mos
Not on ESA: Serum ferritin, iron, TIBC, iron saturation[e]	Q12 mos	Q12 mos	Q6 mos	Q6 mos	Q 3 mos
Urine albumin/creatinine ratio (ACR); if not available, protein/creatinine ratio (PCR)	Q3 mos	Q6 mos	Q4 mos	Q6 mos	Q3 mos

[a] Consider less frequent bloodwork if in line with the patient's goals of care and wishes (e.g., on the conservative care pathway). At a minimum, if patient is on ESA, hemoglobin should be measured every 2 months.
[b] Total calcium is not a good indicator of calcium status in some situations (e.g., high or low serum albumin levels, acid-base disorders). Therefore, ionized calcium is preferred over total calcium.
[c] Ionized calcium is available as part of home collection.
[d] Hemoglobin can be decoupled from CBC at some labs. Recommend ordering hemoglobin, although CBC may be reported.
[e] Aligns with the KDIGO 2025 Clinical Practice Guideline for Anemia in CKD.[2]

GFR (mL/min/1.73²)	Stages 1 - 3		Stage 4		Stage 5 (eGFR <15) [a] &/or Unstable
	eGFR: 30 and Above		eGFR: 15 - 29		
	Onset of Active Monitoring &/or Higher Risk of Progression	Stable Over Time &/or Lower Risk of Progression	Onset of Active Monitoring &/or Higher Risk of Progression	Stable Over Time &/or Lower Risk of Progression	
Hepatitis B (HBsAg, anti-HBc, anti-HBs) (initial screen)	Preparation for dialysis or transplant				
Anti-HBs (monitoring post-vaccination)	Preparation for dialysis or transplant				

**Where possible, try to synchronize the frequency of lab testing with that of other providers to minimize the number of trips to the lab by patients.

See BC Renal KCC Lab Related Guideline and Resources for sample lab requisitions (Adults - single and multi-centre).

c) Children (0 – 18 years)

Table 3: Guidelines on Ordering Lab Work during the Active Monitoring Stage (Children)

GFR (mL/min/1.73²)	Stages 1 - 3		Stage 4		Stage 5 (eGFR <15)[f] &/or Unstable
	eGFR: 30 and Above		eGFR: 15 - 29		
	Onset of Active Monitoring &/or Higher Risk of Progression	Stable Over Time &/or Lower Risk of Progression	Onset of Active Monitoring &/or Higher Risk of Progression	Stable Over Time &/or Lower Risk of Progression	
Creatinine, urea, potassium, sodium, bicarb (CO_2), chloride	Q3 mos	Q6 mos	Q2 mos	Q3 mos	Q1 mo
Phosphorus	Q3 mos	Q6 mos	Q2 mos	Q3 mos	Q1 mo
Albumin	Q3 mos	Q6 mos	Q2 mos	Q3 mos	Q1 mo
Ionized calcium if available; if not, total calcium[g]	Q3 mos	Q6 mos	Q2 mos	Q3 mos	Q1 mo
Parathyroid hormone intact (iPTH)	Q3 mos	Q6 mos	Q2 mos	Q3 mos	Q3 mos
Hematology profile (CBC)	Q3 mos	Q6 mos	Q2 mos	Q3 mos	Q1 mo
On ESA: Hemoglobin only[h,i]	Q1 mo	Q1 mo	Q1 mo	Q1 mo	

[f] Consider changing to Q2 mos if stable.
[g] Ionized calcium is available as part of home collection.
[h] Hemoglobin can be decoupled from CBC at some labs. Recommend ordering hemoglobin, although CBC may be reported.
[i] Consider changing to Q2 mos if stable.

GFR (mL/min/1.73²)	Stages 1 - 3		Stage 4		Stage 5 (eGFR <15)[f] &/or Unstable
	eGFR: 30 and Above		eGFR: 15 - 29		
	Onset of Active Monitoring &/or Higher Risk of Progression	Stable Over Time &/or Lower Risk of Progression	Onset of Active Monitoring &/or Higher Risk of Progression	Stable Over Time &/or Lower Risk of Progression	
On ESA: Serum ferritin, iron, TIBC, iron saturation[j]	Q3 mos	Q3 mos	Q2 mos	Q3 mos	Q3 mos
Not on ESA: Serum ferritin, iron, TIBC, iron saturation[j]	Q3 mos	Q6 mos	Q2 mos	Q3 mos	Q3 mos
Urine albumin/creatinine ratio (ACR); if not available, protein/creatinine ratio (PCR)	Q3 mos	Q6 mos	Q2 mos	Q3 mos	Q3 mos
Hemoglobin A1C, TChol, LDL, HDL, Non-HDL, Triglycerides, CRP, TSH, uric acid, magnesium	Q12 mos	Q12 mos	Q12 mos	Q12 mos	Q12 mos
25-OH Vit D[k]	Q12 mos	Q12 mos	Q12 mos	Q12 mos	Q12 mos
AST, ALT, ALP, GGT, bilirubin[l] (optional)	Q12 mos	Q12 mos	Q12 mos	Q12 mos	Q12 mos

**Where possible, try to synchronize the frequency of lab testing with that of other providers to minimize the number of trips to the lab by patients.

See BC Renal KCC Lab Related Guideline and Resources for sample lab requisition (Children, single centre).

2.2 Reviewing and follow-up of lab work

a) Recommendations

1. KCCs develop a workflow for screening newly available lab results *each day* that the KCC is open.
   - For critical values, the lab will alert the attending nephrologist, renal nurse practitioner and/or KCC as per the Health Authority (HA)/lab protocol.
   - Consider utilizing the Lab List Builder in PROMIS. This report allows staff to filter lab work for specific patients and/or specific lab tests.
   - Different subspecialty clinics e.g. PKD, GN have their own appropriate lab flowsheet integrated into PROMIS. Each clinic should:

[j] Aligns with the 2025 Clinical Practice Guideline for Anemia in CKD.[2]
[k] Consider increased frequency in <2 years of age as per the Pediatric Renal nutrition Taskforce: Mineral and Bone Disorders in Infants.
[l] Consider adding liver function and liver enzymes for those children with conditions associated with or at risk for liver disease.

(1) Ensure the right flowsheet is being used in the clinic
(2) Ensure the right flowsheet is being screened for each patient

- Encourage patients to check their own lab results electronically, where available. See section 1.0 ("Scope") for patient-facing resources.

2. KCCs develop a workflow for follow-up of out-of-range lab results.
   - See Table 4 for a recommended process for initiating screening/follow-up of out-of-range lab results.
   - See Tables 5 and 6 for a list of recommended timelines for initiating screening/follow-up of out-of-range lab results for adults (Table 5) and children (Table 6).
   - For tests ordered by non-KCC physicians, it is the ordering physician's responsibility to initiate follow-up on out-of-range values. However, if a KCC team member becomes aware of a concerning lab result ordered by another physician/clinic, the team member should ensure that the appropriate care provider(s) is alerted.

b) Process for Initiating Screening/Follow-Up of Out-of-Range Lab Results

Table 4: Process for Initiating Screening/Follow-Up of Out-of-Range Lab Results

Step	
1	Check if there are multiple out-of-range lab values (e.g., high potassium; low bicarbonate; significant increase in creatinine).
2	Check if the out-of-range value(s) is consistent with previous values. i.e., known, pre-existing out-of-range value vs a new finding. If out-of-range value(s) is consistent with previous values, has the patient received the relevant information/teaching? • If NO, follow-up is required. • If YES, follow-up may not be required.
3	Check when the patient is scheduled for their next appointment. • For example, if the initiation of follow-up/screening window is "within 1 week" on Table 5, consider holding off until the next appointment if the appointment is soon.
4	Decide within the team who will do the initial screening/follow-up with the patient. Whenever possible, limit to one KCC team member.
5	Contact patient for the initial screening/follow-up. Refer to Appendix 1 for guidance on information to collect during the initial screening/follow-up.
6	Based on screening/follow-up findings, involve other KCC team members, as appropriate (e.g., nephrologist, dietitian, pharmacist, etc).

c) Suggested Timeframes for Initial Screening/Follow-Up of Out-of Range Lab Results

Table 5: Suggested Timeframes for Initial Screening/Follow-Up of Out-of-Range Results (Adults)

Test	Normal		Initial Screening/Follow-up Timelines (upon identification of out-of-range value)[m]			
			Lab will Call MD (Alert/Critical)	**By Next Business Day**	**Within 1 Week** *Note 1*	**Next Appt (not urgent)** *Note 2*
Creatinine (umol/L)	F: 45 – 90 M: 45 - 110	High		↑>35%	↑20% - 34%	↑<20%
Potassium (mmol/L)[n]	3.5 – 5.0	Low	<2.8	2.8 – 3.0	3.1 – 3.2	3.3 – 3.4
		High	>6.2	6.0 – 6.2	5.7– 5.9	5.1 – 5.6
Sodium (mmol/L)	135 – 145	Low	<120	120 – 125	126 – 130	131 – 134
		High	>160	150 – 160	146 – 149	
Phosphorus (mmol/L)	0.80 – 1.50	Low	<0.32	n/a	n/a	All values except critical
		High	n/a	n/a	n/a	All values
Bicarbonate	20 – 30	Low	<10	10 – 16	n/a	17 – 20
		High	>40	n/a	n/a	31 – 40
Ionized calcium (mmol/L)	1.15 – 1.40	Low	<0.80	0.80 – 0.90	0.91 – 1.00	1.01 – 1.14
		High	>1.61	1.50 – 1.60	1.41 – 1.49	n/a
Total calcium (mmol/L)	2.10 – 2.60	Low	<1.50	1.50 – 1.80	1.81 – 1.99	2.00 – 2.09
		High	>3.25	2.90 – 3.25	2.70 – 2.89	2.61 – 2.69
If on anemia protocol or on ESA, see *Note 3*.						
If not on anemia protocol (ESA), hemoglobin (g/L)	F: 115 – 155 M: 135 - 170	Low	<60	60 – 84 or ↓15 or more	85 – 90	F: 91 – 114 M: 91 – 134
If not on anemia protocol (ESA), serum ferritin, iron, TIBC, iron saturation					TSAT <0.10	All other cases

Non-critical out-of-range values which can generally be left until the next appointment (not urgent):

- Chloride
- Albumin
- Hemoglobin A1c
- Hematology profile (CBC) other than hemoglobin
- Parathyroid hormone intact (iPTH)
- Albumin/creatinine ratio (ACR) if available; if not, urine protein/creatinine ratio (PCR)
- Hepatitis B tests (HBsAg, anti-HBc, anti-HBs)

[m] Dietitians, based on their assessment, may contact patients sooner than indicated in this guideline for changes in potassium and/or bicarbonate.

[n] Large changes in potassium (K) values may warrant follow-up sooner than indicated in this guide (e.g. if the change in K is from 3.9 to 5.9, this will need addressing sooner than within 1 week).

Note 1: Consider holding off follow-up until the next appointment if the next appointment is less than 4 weeks away.

Note 2: Flag results for the nephrologist to review at the patient's next appointment. If clinically indicated and/or KCC staff member is concerned, contact the nephrologist sooner.

Note 3: Anemia management for those on ESA:

- Refer to CKD Non-Dialysis Anemia Management Protocol for assessment and actions.
- Timeframes for implementing CKD Non-Dialysis Anemia Management Protocol:
  - Increase in Hgb of 15 g/L or greater within the last 5 weeks, by next business day.
  - Decrease in Hgb of 15 g/L or greater since the last blood work, by next business day.
  - If Hgb is less than 85 g/L OR if Hgb is greater than 139 g/L, by next business day.
  - All other out-of-target values, within 1 week.

Table 6: Suggested Timeframes for Initial Screening/Follow-Up of Out-of-Range Results (Children)

Test	Normal		Initial Screening/Follow-up Timelines (upon identification of out-of-range value)			
			Lab will Call MD (Alert/Critical)	**By Next Business Day**	**Within 1 Week** *Note 1*	**Next Appt (not urgent)** *Note 2*
Creatinine (umol/L)		High		↑>30%	↑20% – 29%	↑<20%
Urea (mmol/L)		High			≥40	All abnormal values <40
Potassium (mmol/L)	3.5 – 5.0	Low	<2.8	2.8 – 3.0	3.1 – 3.2	3.3 – 3.4
		High	>6.2 *Note 3*	6.0 – 6.2	5.7 – 5.9 Note 4	5.1 – 5.6
Sodium (mmol/L)	135 – 145	Low	<120	120 – 125	126 – 130	131 – 134
		High	>160	150 – 160		
Phosphorus (mmol/L)	0.80 – 1.50	Low	<0.32	0.32 – 0.50	0.5 – 0.8	All values except critical
		High	n/a	>3.0	n/a	≤3.0
Bicarbonate	20 – 30	Low	<10	10 – 15	n/a	16 – 20
		High	>40	n/a	n/a	31 – 40
Ionized calcium (mmol/L)	1.15 – 1.40	Low	<0.80	0.80 – 0.90	0.91 – 1.00	1.01 – 1.14
		High	>1.61	1.50 – 1.60	n/a	1.41 – 1.49
Hemoglobin (g/L) *Note 5*		Low	<60 *(Note 6)*	60 – 80 or change of ≥20	81 – 90	>90

Non-critical out-of-range values which can generally be left until the next appointment for follow-up (not urgent):

- Chloride
- Albumin
- Hemoglobin A1c
- Hematology profile (CBC) other than hemoglobin
- Parathyroid hormone intact (iPTH)
- If not on ESA, iron studies (serum ferritin, iron, TIBC, iron saturation). If on ESA, see note 3 below.
- Albumin/creatinine ratio (ACR) if available; if not, urine protein/creatinine ratio (PCR)
- Cholesterol tests (TChol, LDL, HDL, Non-HDL, Triglycerides), CRP, 25-OH Vit D, TSH, uric acid, magnesium

Note 1: Consider holding off follow-up until the next appointment if the next appointment is less than 4 weeks away.

Note 2: Flag these results for the nephrologist to review at the patient's next appointment. If clinically indicated and/or the KCC staff member is concerned, contact the nephrologist sooner.

Note 3: For children aged <3 months, the lab critical value is for a serum potassium of more than 6.5 mmol/L.

Note 4: Does not apply to neonates.

Note 5: Anemia management for those on ESA:

- *Refer to BCCH Pediatric CKD Anemia Management for assessment and actions.*
- *Timeframes for implementing BCCH Pediatric CKD Anemia Management Protocol:*
  - *Increase in Hgb of 20 g/L or greater in a month, by next business day.*
  - *Decrease in Hgb of 20 g/L or greater in a month, by next business day.*
  - *If Hgb is less than 100 g/L, by next business day.*
  - *If Hgb is more than 140 g/L, by next business day.*
  - *All other out-of-target values, within 1 week.*

Note 6: For children aged < 30 days, the lab critical value is for a hemoglobin of less than 80 g/L.

Critical alert values:

BC: https://lifelabs.azureedge.net/lifelabs-wp-cdn/2021/04/Critical-Laboratory-Test-Results-British-Columbia.pdf

Reference ranges:

BC: https://lifelabs.azureedge.net/lifelabs-wp-cdn/2018/10/brl_ranges.pdf
Vancouver Island: https://lifelabs.azureedge.net/lifelabs-wp-cdn/2018/10/vrl_ranges.pdf

3.0 References

1. KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. *Kidney International*. 2024;105(4):A1. doi:10.1016/S0085-2538(24)00110-8

2. Anemia in CKD – KDIGO. Accessed March 7, 2025. https://kdigo.org/guidelines/anemia-in-ckd/

3. Holden RM, Mustafa RA, Alexander RT, et al. Canadian Society of Nephrology Commentary on the Kidney Disease Improving Global Outcomes 2017 Clinical Practice Guideline Update for the Diagnosis, Evaluation, Prevention, and Treatment of Chronic Kidney Disease-Mineral and Bone Disorder. *Can J Kidney Health Dis*. 2020;7:2054358120944271. doi:10.1177/2054358120944271

4. Bacchetta J, Schmitt CP, Bakkaloglu SA, et al. Diagnosis and management of mineral and bone disorders in infants with CKD: clinical practice points from the ESPN CKD-MBD and Dialysis working groups and the Pediatric Renal Nutrition Taskforce. *Pediatr Nephrol*. 2023;38(9):3163-3181. doi:10.1007/s00467-022-05825-6

5. Shaw V, Polderman N, Renken-Terhaerdt J, et al. Energy and protein requirements for children with CKD stages 2-5 and on dialysis-clinical practice recommendations from the Pediatric Renal Nutrition Taskforce. *Pediatr Nephrol*. 2020;35(3):519-531. doi:10.1007/s00467-019-04426-0

6. McAlister L, Pugh P, Greenbaum L, et al. The dietary management of calcium and phosphate in children with CKD stages 2-5 and on dialysis-clinical practice recommendation from the Pediatric Renal Nutrition Taskforce. *Pediatr Nephrol*. 2020;35(3):501-518. doi:10.1007/s00467-019-04370-z

7. Desloovere A, Renken-Terhaerdt J, Tuokkola J, et al. The dietary management of potassium in children with CKD stages 2-5 and on dialysis-clinical practice recommendations from the Pediatric Renal Nutrition Taskforce. *Pediatr Nephrol*. 2021;36(6):1331-1346. doi:10.1007/s00467-021-04923-1

8. Stevens PE, Ahmed SB, Carrero JJ, et al. KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. *Kidney international*. 2024;105(4):S117-S314.

4.0 Sponsors

Developed by:

- Working Group of KCC multidisciplinary care providers (nephrologists, dietitians, pharmacists and registered nurses) from across BC: 2013; 2018; 2025.

Approved by:

- BC Renal (BCR) Kidney Care Clinic (KCC) Committee: July 2018; June 2020 (update sample lab requisitions), 2025.
- BCR Medical Advisory Committee: July 2018; June 2020 (update sample lab requisitions), 2025.

Appendix 1: Screening/Initial Follow-up of Out-of-Range Results

All out-of-range values

1. Illnesses & procedures

a. Do you have any new health problems, or have you been to hospital since we last saw you?
b. Have you had any procedures or recent imaging?
c. Have you been ill? (e.g., vomiting, diarrhea, fever)

2. Eating & drinking

a. Have you been eating and drinking as usual? (e.g., changes to your diet, staying hydrated, fasting prior to the lab test).

3. Medications & supplements

a. What medications/supplements are you currently taking? (compare with prescribed medications and, if accessible, compare with PharmaNet)
b. Have you started any new medications/supplements, stopped any previous ones or had any changed? (e.g., ACEi, ARB, diuretic, NSAIDs, antibiotics)

4. Symptoms

a. Are you experiencing any of the symptoms listed in Table 7? If so, when did it start to bother you? How severe is it? Is it improving or getting worse?

Note: There may be little correlation between reported symptoms and out-of-range lab values.

- Many patients, even with significantly out-of-range results, do not report any of the symptoms listed in Table 7.
- Some patients will report one or more of the symptoms listed in Table 7, but the corresponding lab value is normal.

5. Additional questions specific to out-of-range value

Table 7: Potential Symptoms Associated with Significantly Out-of-Range Values & Questions Relevant for Initial Follow-Up/Screening

Value	Value	Potential Symptoms	Examples of Questions to Assess for Potential Causes of Lab Abnormality[o]
Creatinine	High	• Urinating less or more, passing bloody or foamy urine • Swelling in feet, ankles or face • Nausea and vomiting or diarrhea • Other: High BP, muscle cramps, chest pain, confusion, SOB	Have you noticed changes in your voiding habits? (e.g., difficulty voiding, pain).

[o] These questions are in addition to the initial questions asked to assess any out-of-range lab result (i.e., recent illnesses & procedures and changes in eating & drinking and medications & supplements).

Value	Value	Potential Symptoms	Examples of Questions to Assess for Potential Causes of Lab Abnormality[O]
Potassium Refer to Appendix 2 for factors influencing potassium levels	High	• Muscle weakness, tingling, numbness • Severe: chest pain, heart palpitations, SOB • Nausea and vomiting	Were you prescribed a potassium binder? If so, are you taking it as prescribed? Are you taking a potassium supplement? Where did you have your labs drawn? (if accuracy of test is in doubt, repeat at hospital lab as per nephrologist's order) High potassium levels can be due to high blood sugars. Do you have diabetes? If so, how are your blood sugars? Constipation can cause high potassium levels. Have you had any issues with constipation?
	Low	• Heart palpitations • Muscle weakness and spasms • Tingling and numbness	Certain water pills (thiazide/loop diuretics) can cause low potassium levels. Are you taking a water pill? Were you prescribed a potassium binder? If so, are you taking it as prescribed? Were you prescribed a potassium supplement? If so, are you taking it as prescribed?
Sodium	High	• Excessive thirst • Decreased energy, lethargy • Urinating very little or lots of dilute urine • Vomiting	High sodium levels can be due to dehydration. • Are you taking a water pill? • How much fluid are you drinking daily?
	Low	• Confusion • Nausea and vomiting • Headache • Restlessness and irritability • Muscle weakness, spasms or cramps	Low sodium levels can be due to too much fluid in your body. • Are you dehydrated and have you experienced vomiting or diarrhea, which could lead to dehydration? • Any change in your swelling or body weight? • How much fluid are you drinking daily? Certain water pills (thiazide diuretics, amiloride) can cause low sodium levels. Are you taking any water pills?
Bicarbonate	High	• Confusion • Muscle twitching/cramps • Tingling and numbness • Abnormal heart rhythm • Seizures	Certain water pills (thiazide/loop diuretics) can cause high bicarbonate levels. Are you taking a water pill?

Value	Value	Potential Symptoms	Examples of Questions to Assess for Potential Causes of Lab Abnormality[p]
Bicarbonate cont'd	Low	• Rapid and deep breathing • Fast heart rate • Confusion or dizziness • Nausea and vomiting	Were you prescribed sodium bicarbonate? If so, are you taking it as prescribed? Poorly controlled blood sugars can cause a condition called diabetic ketoacidosis, leading to low bicarbonate levels. • Do you have diabetes? • If so, how are your blood sugars? Metformin can cause a condition called lactic acidosis, leading to low bicarbonate levels. Are you taking metformin?
Phosphorus	Low	• Muscle weakness • Confusion, irritability • Respiratory or heart failure	Are you eating less than before?
Calcium	High	• Nausea, vomiting, constipation, stomach pain) • Bone pain, muscle weakness • Confusion, difficulty thinking • Increased thirst or frequent urination	Were you prescribed any calcium or vitamin D supplements? If so, are you taking them as prescribed? Are you taking any extra supplements? Do they contain calcium or vitamin D? Dehydration can be both a cause and symptom of high calcium levels. • Are you dehydrated or have you experienced vomiting or diarrhea, which can cause dehydration? • Are you drinking less fluid than usual? • Are you feeling thirstier or urinating more than usual? If so, do you have diabetes, and how are your blood sugars? Certain water pills (thiazide diuretics) can cause high calcium levels. Are you taking any water pills?
	Low	• Muscle cramps, spasms or stiffness • Tingling in the lips, tongue, fingers and toes • Dry, scaly skin, coarse hair and brittle nails	Were you prescribed or taking any calcium or vitamin D supplements? Are you taking them as per previous or as prescribed? Certain osteoporosis medications (bisphosphonates, denosumab) can cause low

[p] These questions are in addition to the initial questions asked to assess any out-of-range lab result (i.e., recent illnesses & procedures and changes in eating & drinking and medications & supplements).

		• Irregular heartbeat or heart failure	calcium levels. Are you taking any osteoporosis medications?

Value	Value	Potential Symptoms	Examples of Questions to Assess for Potential Causes of Lab Abnormality[q]
Hemoglobin, iron studies	Low	• SOB • Pale skin • Weakness • Dizziness	For low hemoglobin: Were you prescribed an ESA (darbepoetin alfa or epoetin alfa)? If so, are you taking as prescribed? Were you prescribed iron supplements? If so, are you taking as prescribed? Have you noticed unusual bleeding (e.g., change in stool colour, recent surgery)?

[q] These questions are in addition to the initial questions asked to assess any out-of-range lab result (i.e., recent illnesses & procedures and changes in eating & drinking and medications & supplements).

Appendix 2: Factors and Mechanisms that Impact Potassium Measurements

Table 25| Factors and mechanisms that impact on potassium measurements[556,569-575]

Factor/mechanism	Possible cause/clinical implication

Pseudohyperkalemia—*in vivo* serum potassium is normal and commonly GFR preserved, but during the process of drawing blood or clotting, there has been a release of intracellular potassium	• Tight tourniquet
	• Hand/arm exercising or clenching at the time of blood draw
	• Hemolysis due to vigorous shaking of blood vial/inappropriate blood draw equipment/inappropriate storage of samples
	  • If suspected, blood should be retaken and analyzed in the appropriate manner and time frame[556,569]
	• Presence of thrombocytosis/leukocytosis
	  • If suspected, take plasma potassium as serum potassium may be falsely increased[570]

Hyperkalemia due to disruption in the mechanism of shifting potassium out of cells	• Increase in plasma osmolarity (e.g., dehydration and hyperglycemia) • Massive tissue breakdown (e.g., rhabdomyolysis and tumor lysis syndrome) • β-adrenergic blockade, especially during and immediately after exercise[569] • Insulin deficiency • Aldosterone blockade • Nonorganic acidosis
Hyperkalemia due to disruption in the mechanism of moving potassium into cells	• Disruption in the release of insulin in response to raised serum potassium (e.g., in uncontrolled diabetes) • Disruption to the release of aldosterone in response to a raised serum potassium[569]
Hyperkalemia due to the decreased ability to excrete potassium	• Advancing CKD resulting in inability to excrete excessive potassium • Constipation: in advancing CKD, the gut assumes a much more important role in maintaining potassium balance by increasing the excretion of potassium[571,572] • Medications: blocking the RAAS pathway and other medication resulting in the inability to excrete excessive potassium (Table 26)[569,573]
Diurnal variation in potassium excretion with most excretion in humans occurring close to noon	• Circadian excretion of kidney electrolytes have been well documented.[574] Clinical relevance is yet to be understood • Note the 0.24–0.73 mmol/l variation in K+ values within individuals over a 24-hour period
Plasma vs. serum potassium values	• Potassium values differ between serum and plasma values with serum values being typically higher. Healthcare providers need to be aware of the right reference values for the sample[570]
Postprandial hyperkalemia	• As kidney function declines in CKD, there is a corresponding decline in the ability of the kidneys to increase kaliuresis postprandially, eventually becoming insufficient to maintain external potassium balance[575]

Source: KDIGO, 2024[8]