

# Medication Safety and Drug Dosing in People with Chronic Kidney Disease

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# Land Acknowledgement

We are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all treaty people.

Acknowledge the histories, contributions and legacies of the African Nova Scotian people and communities who have been here for over 400 years.

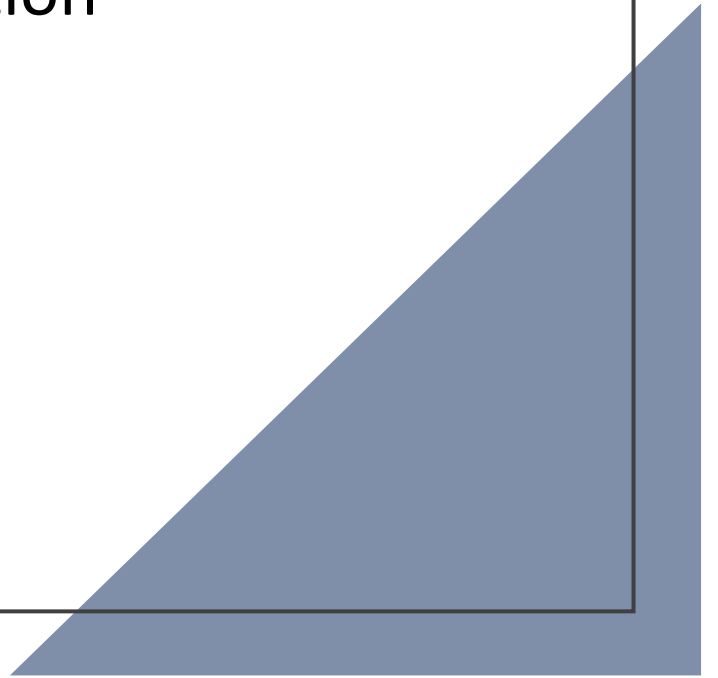


# Presenter Disclosure

- Presenter's Name: Jo-Anne Wilson
- I have the following relationships with commercial interests:
  - Funding (Grants/Honoraria): Pfizer, Bayer
  - Speaker/Consulting Fees: Otsuka, GSK Canada
- Speaking Fees for current program:
  - I have received no speaker's fee for this learning activity

# Commercial Support Disclosure

- This program has received no financial or in-kind support from any commercial or other organization



# Abbreviations and Acronyms

ADRs	adverse drug reactions	LOC	loss of consciousness
AIN	acute interstitial nephritis	NSAIDs	non-steroidal anti-inflammatory drugs
AKI	acute kidney injury	SCr	serum creatinine
BP	blood pressure	SJS	Stevens Johnson syndrome
CKD	chronic kidney disease	TEN	toxic epidermal necrolysis
eGFR	estimated glomerular filtration rate	UACR	urine albumin creatinine ratio
GI	gastrointestinal	UTI	urinary tract infection

# Learning Objectives

At the end of this session, participants will be able to:

Identify	common medications requiring adjustment or avoidance in individuals with CKD
Estimate	kidney function using SCr equations
Adjust	medication regimens (dose or frequency) to reduce the risk of harm, including kidney damage

# Road Map



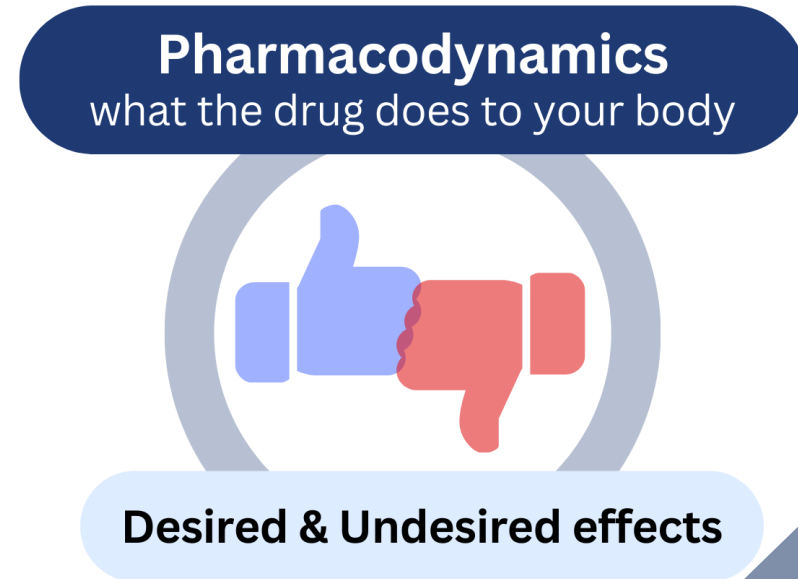
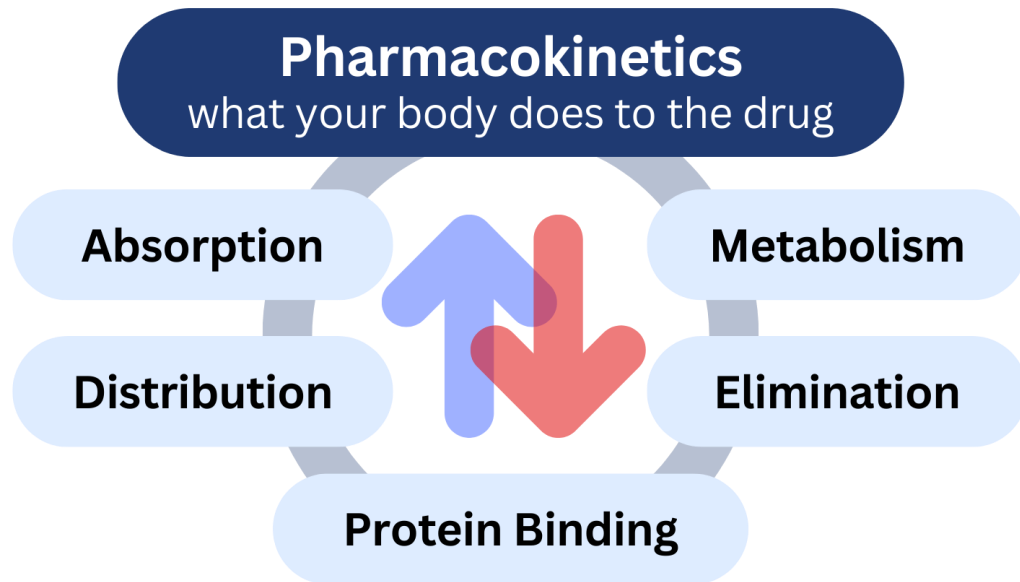
- Why medication safety in CKD matters?
- Anatomy and function of the kidney
- Defining and testing for CKD
- Estimating kidney function using SCr equations
- What are higher-risk medications to adjust or avoid in primary care for those with CKD?
- Case vignette
- Resources

# Why Medication Safety in CKD Matters?

- 1 in 10 Canadians have CKD
- Polypharmacy and comorbidities prevalent
- 2x ADRs when eGFR drops below 30 ml/min
- Reduced ability to excrete medications and or their metabolites
- More susceptible to nephrotoxic effects of medications



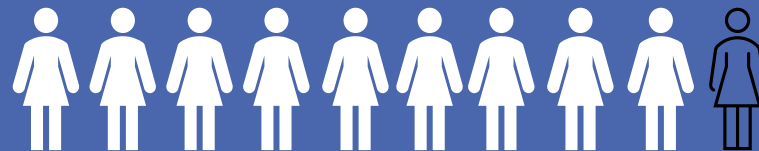
# CKD Can Affect Medications



Most people do not experience symptoms until  
almost 90% of their kidney function is lost

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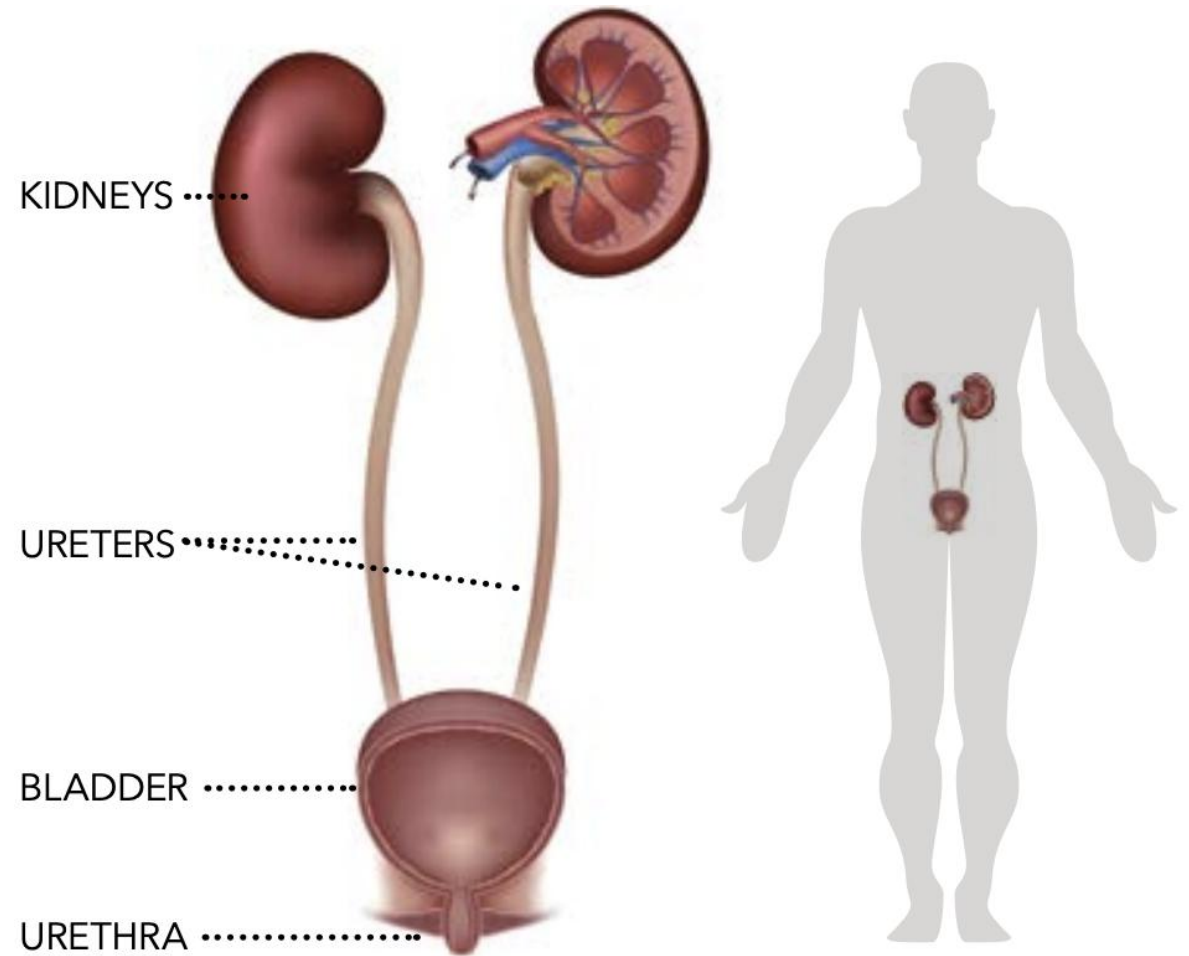
SILENT Disease



# Kidney Anatomy

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- Two bean-shaped organs
- Under the rib cage on either side of the spine
- About the size of your fist
- 10-14 cm long, 100-120 grams



# What are the parts of the kidney?

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**Renal Capsule:** protects kidney from injury.

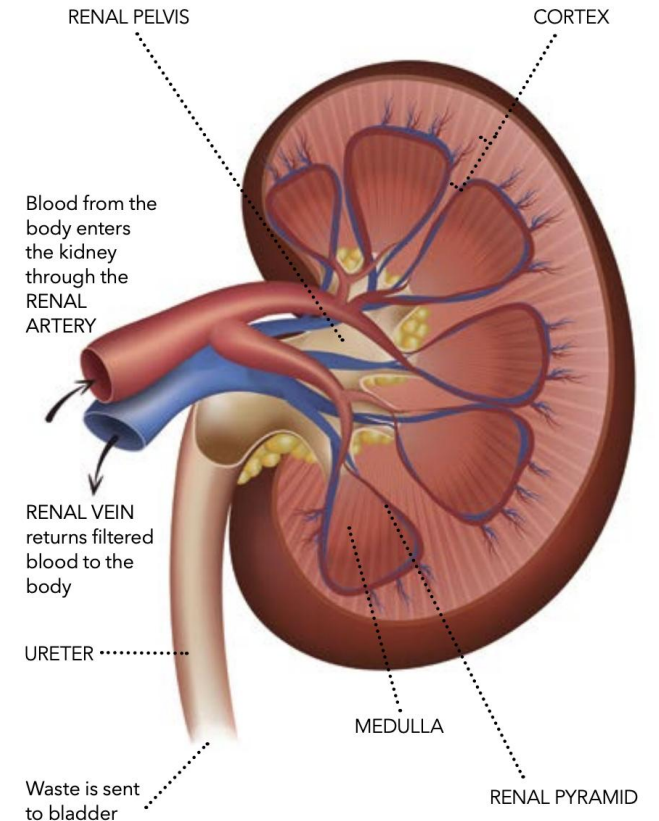
**Renal Artery:** supplies oxygenated unfiltered blood to kidney.

**Cortex:** where filtration via the glomerulus and nephron occurs.

**Papilla:** carries urine collected from nephrons to the renal pelvis.

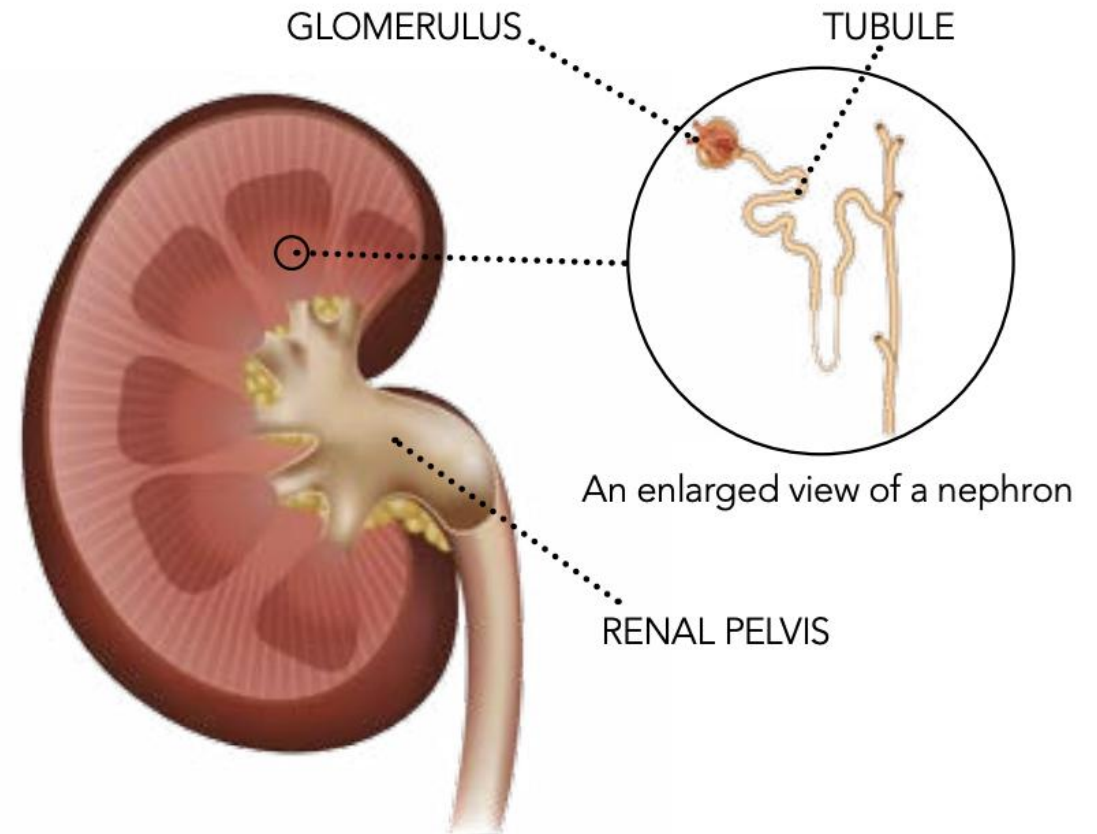
**Renal Pelvis:** collects urine and exports it to the bladder via the ureters.

**Renal Vein:** carries deoxygenated filtered blood back to the heart.



# How do kidneys work?

- Blood flows through the glomerulus, water and waste products are filtered out of the blood via the nephron.
- Water, electrolytes and nutrients are reabsorbed through the tubule.
- The wastes or “filtrate” becomes concentrated and turns into urine.



# What are the functions of the kidney?

Gets rid of  
waste

Controls BP

Makes RBC

Fluid and  
acid/base  
balance

Maintains  
bone health

Removes  
some drugs

# Defining CKD

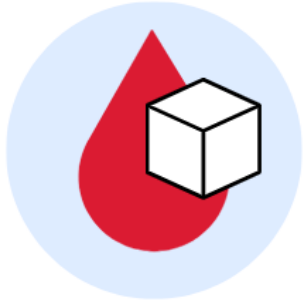


Definition: Abnormalities of kidney structure or function, present for a minimum of 3 months, with implications for health.



Criteria:  $\text{eGFR} < 60 \text{ ml/min/1.73m}^2$  AND/OR Urine ACR  $\geq 3 \text{ mg/mmol}$   $\geq 3$  months

# Who is at risk of CKD?



Diabetes



> 60 years old



Overweight



Smoking



High blood  
pressure



Cardiovascular  
disease



Family member  
with CKD



Kidney  
injury



# Testing for CKD



Blood test (eGFR): Kidney Function



Urine test (UACR): Kidney Damage



Imaging (ultrasound, biopsy): Kidney Structure

# CKD Categories



CKD is classified based on:

- Cause (C)
- GFR (G)
- Albuminuria (A)

				Albuminuria categories		
				Description and range		
				A1	A2	A3
				Normal to mildly increased <30 mg/g <3 mg/mmol	Moderately increased 30–299 mg/g 3–29 mg/mmol	Severely increased ≥300 mg/g ≥30 mg/mmol
GFR categories (ml/min/1.73 m <sup>2</sup> ) Description and range	G1	Normal or high	≥90	Screen 1	Treat 1	Treat 3
	G2	Mildly decreased	60–89	Screen 1	Treat 1	Treat 3
	G3a	Mildly to moderately decreased	45–59	Treat 1	Treat 2	Treat 3
	G3b	Moderately to severely decreased	30–44	Treat 2	Treat 3	Treat 3
	G4	Severely decreased	15–29	Treat* 3	Treat* 3	Treat 4+
	G5	Kidney failure	<15	Treat 4+	Treat 4+	Treat 4+

Low risk (if no other markers of kidney disease, no CKD)

Moderately increased risk

High risk

Very high risk

# Association between eGFR & UACR: Risk for 10 Complications


Overall	Urine albumin-creatinine ratio, mg/g					Urine albumin-creatinine ratio, mg/g				
eGFRcr	<10	10–29	30–299	300–999	1000+	<10	10–29	30–299	300–999	1000+
	All-cause mortality: 82 cohorts 26 444 384 participants; 2 604 028 events					Myocardial infarction: 64 cohorts 22 838 356 participants; 451 063 events				
105+	1.6	2.2	2.9	4.3	5.8	1.1	1.4	2.0	2.7	3.8
90–104	ref	1.3	1.8	2.6	3.1	ref	1.3	1.6	2.2	3.2
60–89	1.0	1.3	1.7	2.2	2.8	1.1	1.3	1.6	2.2	3.1
45–59	1.3	1.6	2.0	2.4	3.1	1.4	1.7	2.0	2.8	3.7
30–44	1.8	2.0	2.5	3.2	3.9	1.9	2.0	2.4	3.2	4.3
15–29	2.8	2.8	3.3	4.1	5.6	2.7	3.1	3.1	4.2	5.1
<15	4.6	5.0	5.3	6.0	7.0	4.6	5.6	4.8	6.0	6.0
	Cardiovascular mortality: 76 cohorts 26 022 346 participants; 776 441 events					Stroke: 68 cohorts 24 746 436 participants; 461 785 events				
105+	1.4	2.0	3.0	4.1	5.4	1.2	1.6	2.2	3.1	4.3
90–104	ref	1.3	1.9	2.7	3.6	ref	1.3	1.6	2.4	3.1
60–89	1.0	1.4	1.7	2.4	3.2	1.1	1.3	1.7	2.2	3.0
45–59	1.4	1.7	2.2	2.8	3.8	1.4	1.6	1.9	2.3	2.9
30–44	2.0	2.3	2.8	3.7	4.6	1.6	1.7	2.0	2.4	3.0
15–29	3.2	3.1	3.5	5.0	6.5	1.8	2.1	2.1	2.7	3.0
<15	6.1	6.4	6.4	7.3	8.2	3.2	2.8	2.9	3.2	3.8
	Kidney failure with replacement therapy: 57 cohorts 25 466 956 participants; 158 846 events					Heart failure: 61 cohorts 24 603 016 participants; 1 132 443 events				
105+	0.5	1.2	2.9	7.7	25	1.2	1.7	2.7	4.2	6.9
90–104	ref	1.8	4.3	12	43	ref	1.3	2.0	2.8	4.2
60–89	2.3	4.9	10	27	85	1.1	1.4	1.9	2.7	4.2
45–59	13	19	37	89	236	1.6	1.8	2.4	3.4	5.0
30–44	50	58	115	240	463	2.2	2.5	3.1	4.2	6.5
15–29	283	301	443	796	1253	3.6	3.5	4.1	5.8	8.1
<15	770	1040	1618	2297	2547	5.1	5.7	5.8	7.9	9.9
	Acute kidney injury: 49 cohorts 23 914 614 participants; 1 408 929 events					Atrial fibrillation: 50 cohorts 22 886 642 participants; 1 068 701 events				
105+	1.0	1.6	2.4	3.7	5.5	1.1	1.3	1.7	2.4	3.5
90–104	ref	1.4	2.1	3.2	5.0	ref	1.2	1.5	1.9	2.3
60–89	1.6	2.2	3.1	4.3	6.7	1.0	1.2	1.4	1.7	2.2
45–59	3.5	4.0	5.1	6.9	9.0	1.2	1.3	1.5	1.8	2.4
30–44	5.6	5.9	6.8	8.6	11	1.4	1.5	1.7	2.0	2.4
15–29	8.3	8.0	8.5	9.9	10	1.9	1.8	2.0	2.6	3.0
<15	8.5	11	7.9	5.5	5.7	2.6	2.5	3.1	3.6	4.2
	Hospitalization: 49 cohorts 25 426 722 participants; 8 398 637 events					Peripheral artery disease: 54 cohorts 24 830 794 participants; 378 924 events				
105+	1.4	1.7	2.1	2.1	2.3	0.9	1.4	1.9	2.8	5.0
90–104	ref	1.1	1.3	1.5	1.7	ref	1.3	1.9	2.8	4.3
60–89	1.0	1.1	1.3	1.5	1.8	1.0	1.3	1.8	2.5	3.8
45–59	1.3	1.3	1.5	1.7	2.1	1.5	1.7	2.1	2.9	4.2
30–44	1.5	1.5	1.6	1.9	2.3	2.0	1.9	2.5	3.6	5.0
15–29	1.8	1.8	1.9	2.4	2.8	3.3	3.3	3.8	5.7	8.1
<15	2.7	2.8	3.0	3.2	3.8	9.1	9.0	9.6	13	14

# Calculating an Individuals Kidney Failure Risk: CKD Stage 3 – 5

Calculate CKD Risk Here

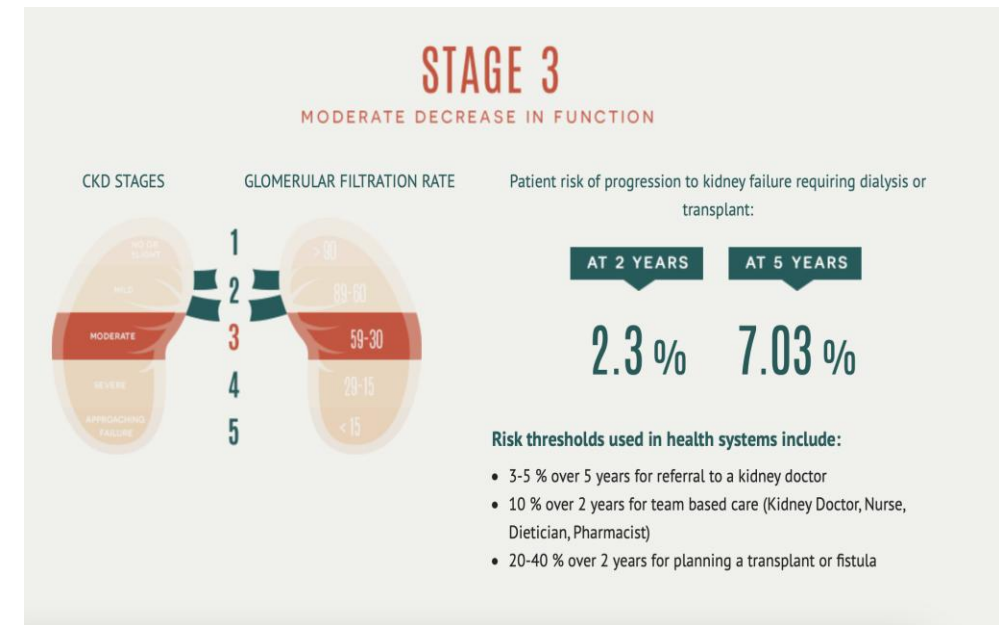
## THE KIDNEY FAILURE RISK EQUATION

Find out your real risk of kidney failure



**KIDNEY FAILURE  
RISK CALCULATOR**

**LEARN MORE ABOUT  
YOUR KIDNEYS**



# Common Symptoms Later in CKD

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Fatigue



Bone pain



Pruritis



Nausea, low appetite

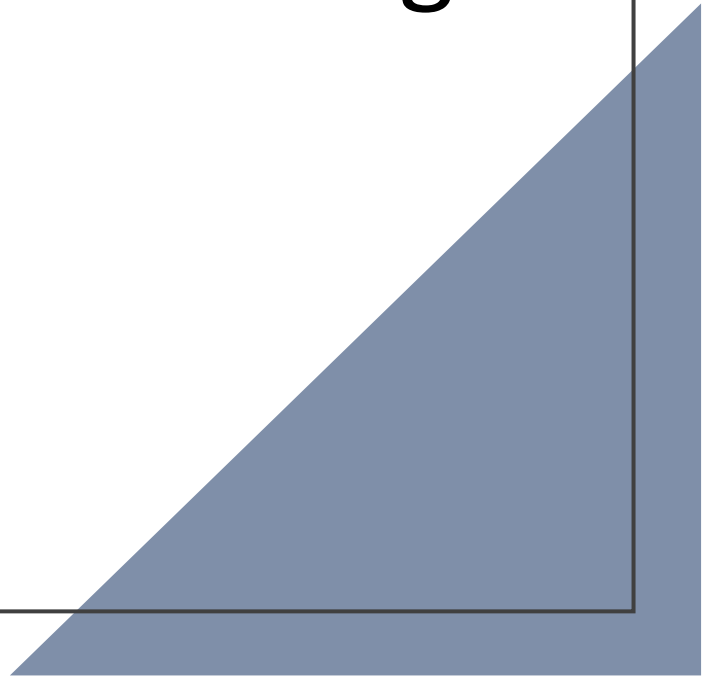








Pedal edema



Changes to quality/quantity of urine

What estimation equations are used drug dosing decisions?



	Cockcroft-Gault eCrCl 1976	CKD-EPI eGFR 2021
 Study design	Two measurements of 24h creatinine excretion per kg, n=249	Cross-sectional validation analysis, n=4,050 estimation of GFR using SCr
 Population	18-92 yrs, mCrCl 73 all white men	median age 57, mGFR 76.6, 38% female, 14% black
 Equations	CrCl = $1.2(140 - \text{age}) \times \text{weight} / \text{SCr}$ [* 0.85 if female]	eGFR (refit) = $142 * \min(\text{SCr}/K, 1)^{\alpha} * \max(\text{SCr}/K, 1)^{-1.200} * 0.9938^{\text{Age}}$ [1.012- if female]
 Race/sex	15% estimated adjustment for female No race variable	No race variable
 Limitations	Developed using unstandardized SCr, uses weight, no female or black	Limited number of black patients with low eGFR; using both CysC + SCr most accurate
 Unit	ml/min	ml/min/1.73m <sup>2</sup>

# eGFR for Drug Dosing Decisions



eGFR (ml/min/1.73m <sup>2</sup> )	90	90
BSA (m <sup>2</sup> )	2.70	1.55
eGFR (ml/min)	140	80

## The Problem

- Lab reports eGFR in ml/min/1.73m<sup>2</sup>

## The issue?

- Kidney drug clearance is proportional to individual's mGFR (ml/min), not BSA of 1.73m<sup>2</sup>

## What to do?

- Adjust for individual's BSA, eGFR<sub>BSA-adj</sub> (ml/min)

## When?

- In overweight or underweight

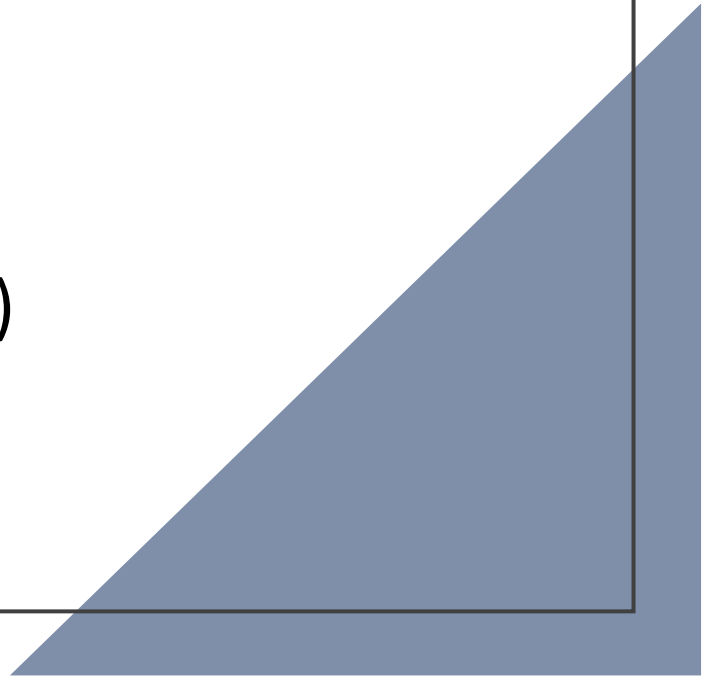


# The Transition to eGFR

- Gold standard for assessing kidney filtration and overall kidney function
- 2024 FDA industry guidance recommends eGFR over eCrCl
- Better than CG eCrCl in predicting drug clearance
- 2024 KDIGO recommends validated 2021 eGFR equation (ml/min/1.73m<sup>2</sup>)

# Limitations of SCr Based Equations

- Assumes stable kidney function
- Body habitus and changes in muscle mass
- Diet (high in protein, creatine supplements)
- Drug-induced tubular secretion of creatinine (TMP)



# 2021 CKD-EPI eGFR (ml/min/1.73m<sup>2</sup>)

- Convert units to ml/min for **dose dosing decision**

1. eGFR (ml/min/1.73m<sup>2</sup>) x Individual's BSA/1.73 = eGFR (ml/min)

2. NKF eGFR Calculator



BSA (m<sup>2</sup>) =  $\sqrt{\text{Height (cm)} \times \text{Weight (kg)} / 3600}$   
body-surface-area-calculator

- Future: Cystatin C combined with creatinine (eGFR<sub>cr-cys</sub>) provides better eGFR
- Cystatin C referred out test

# Cockcroft Gault CrCl (ml/min)

$$\text{CrCl (ml/min)} = [1.2(140 - \text{age})(\text{IBW}) / \text{SCr (umol/L)}] \times 0.85 \text{ (females)}$$

- IBW= Ideal Body Weight (kg)

$$\text{IBW men (kg)} = 50\text{kg} + (0.91 \times [\text{Height (cm)} - 152.4])$$

$$\text{IBW women (kg)} = 45.5\text{kg} + (0.91 \times [\text{Height (cm)} - 152.4])$$

- Unstandardized SCr used prior 2009.

# What are Higher-Risk Medications to Adjust or Avoid in Primary Care for People with CKD?

Wilson et al. *BMC Nephrology* (2024) 25:386  
<https://doi.org/10.1186/s12882-024-03829-y>









BMC Nephrology

RESEARCH

Open Access

Medications for community pharmacists to dose adjust or avoid to enhance prescribing safety in individuals with advanced chronic kidney disease: a scoping review and modified Delphi



Jo-Anne Wilson<sup>1,10\*</sup> , Natalie Ratajczak<sup>1†</sup>, Katie Halliday<sup>1†</sup>, Marisa Battistella<sup>2,3</sup> , Heather Naylor<sup>4,5</sup> ,  
Maneka Sheffield<sup>6</sup>, Judith G. Marin<sup>7,8</sup> , Jennifer Pitman<sup>9</sup> , Natalie Kennie-Kaulbach<sup>1</sup> ,  
Shanna Trenaman<sup>1,10</sup>  and Louise Gillis<sup>11</sup> 

# Common Medications to Dose-Adjust in CKD

Metformin	Allopurinol
Glyburide	Colchicine
Sitagliptin	Apixaban
Rosuvastatin	Rivaroxaban
Fenofibrate	Dabigatran
Gabapentin	Famotidine
Pregabalin	Ranitidine
Digoxin	Methotrexate

Acyclovir	Nitrofurantoin
Valacyclovir	NSAIDs
Ciprofloxacin	Baclofen
Levofloxacin	Morphine
TMP/SMX	Codeine
Amoxicillin/ Clavulanate	Tramadol
	Lithium

# The Hidden Risks of Medications in CKD

Medication	Risks	Medication	Risks	Medication	Risks
Metformin	Lactic acidosis (muscle aches, rapid breathing, GI, mortality)	Rosuvastatin	Rhabdomyolysis (muscle pain, stiffness, cramping, dark urine, fatigue), proteinuria, hematuria, AKI	NSAIDs	AKI, AIN, hyperkalemia, ↑BP
Glyburide	Severe hypoglycemia (confusion, LOC)	Gabapentin Pregabalin	Encephalopathy, confusion, sedation, falls, respiratory depression, LOC	Morphine Codeine	GI, sedation, respiratory depression, LOC
Sitagliptin	Nasopharyngitis, arthralgia, GI, hypoglycemia	Allopurinol	AHS, severe cutaneous reaction (rash), hospitalization, mortality	Tramadol	Sedation, respiratory depression, LOC, seizures, QT prolongation
Fenofibrate	Rhabdomyolysis (muscle pain, stiffness, cramping, dark urine, fatigue)	Colchicine	Myopathy, rhabdomyolysis, GI, bone marrow toxicity (leukopenia, pancytopenia)	Apixaban, Rivaroxaban Dabigatran	Bleeding (intracranial, GI), unexplained bruising

Medication	Risks	Medication	Risks
Valacyclovir Acyclovir	AKI (obstructive nephropathy, interstitial nephritis, renal tubular necrosis) Neurotoxicity (agitation, confusion, hallucination, LOC, seizures)	MTX	AKI, nephrotoxicity Bone marrow suppression Toxicity (GI, Lung, Liver)
Levofloxacin Ciprofloxacin	Interstitial nephritis, crystalluria CNS effects (seizures, confusion) psychiatric (delirium), tendon rupture	Lithium	Lithium – induced nephropathy, Nephrogenic diabetes insipidus
Amoxicillin - Clavulanate	Kidney injury, crystalluria, AIN, GI	Ranitidine Famotidine	Neurological symptoms (lethargy, confusion, somnolence, disorientation, hallucinations), falls
		PPIs	AKI or CKD due to AIN
SMX/TMP	Hyperkalemia, hematologic effects (agranulocytosis and aplastic anemia), liver injury, dermatologic (SJS, TEN)	Digoxin	GI, life-threatening arrhythmias, dizziness, headaches, altered mental status
Nitrofurantoin	Sensory/motor dysfunction, AIN, UTI treatment failure, pulmonary pain and/or pleural effusion	Baclofen	Encephalopathy (delirium, confusion, dementia, cerebral ischemic attack)





Ontario Renal Network



## Medication Safety for People on Dialysis

You may be taking multiple medications to treat your kidney disease or other conditions. If you are on dialysis, some medications could potentially harm you.

**You should generally avoid these medications if you are on dialysis:**

- Baclofen
- Methotrexate
- Glyburide
- Dabigatran



Talk with your kidney care team, pharmacist or family doctor about all of your medications to make sure they are safe. If being prescribed new medications, remind your care team that you are on dialysis.

JAMA | Original Investigation

## Association of Baclofen With Encephalopathy in Patients With Chronic Kidney Disease

Flory T. Muanda, MD, PhD; Matthew A. Weir, MD, MSc; Lavanya Bathini, MD; Peter G. Blake, MB, FRCP; Kianna Chauvin, BSc; Stephanie N. Dixon, PhD; Eric McArthur, MSc; Jessica M. Sontrop, PhD; Louise Moist, MD, MSc; Amit X. Garg, MD, PhD



[AJKD](#)

## Association of Baclofen With Falls and Fractures in Patients With CKD

Muanda FT, Blake PG, Weir MA, Bathini L, Chauvin K, Dixon SN, McArthur E, Sontrop JM, Moist L, Kim RB, Garg AX



[www.kidney-international.org](http://www.kidney-international.org)

clinical investigation

## Baclofen has a risk of encephalopathy in older adults receiving dialysis

Kianna J. Chauvin<sup>1,2</sup>, Peter G. Blake<sup>2</sup>, Amit X. Garg<sup>1,2,3</sup>, Matthew A. Weir<sup>1,2,3</sup>, Lavanya Bathini<sup>1,2</sup>, Stephanie N. Dixon<sup>1,3</sup>, Eric McArthur<sup>1</sup>, Jessica M. Sontrop<sup>2,3</sup>, Louise Moist<sup>2,3</sup>, Richard B. Kim<sup>4</sup> and Flory T. Muanda<sup>1,3</sup>

# Baclofen



FALL 2018

## Coroner's Inquest into the Death Of A Hemodialysis Patient On Methotrexate

December 4, 2018

A 48-year-old male who was being treated for end stage renal disease died as a result of sepsis, subsequent to pancytopenia caused by Methotrexate (MTX) prescribed for treatment of sarcoidosis. Contributing causes of death were determined to be E. coli septicemia due to bone marrow hypoplasia due to MTX toxicity due to end stage renal disease due to polycystic kidney disease.

# Methotrexate

[ismpcanada MethotrexateRenalDisease; OCP\\_pharmacyconnection MTX coronersinquestfall-2018](#)

JAMA Network Open. 2023;6(11):e2345132.

## ISMP Canada Safety Bulletin

Volume 22 • Issue 3 • March 17, 2022

### Heightened Risk of Methotrexate Toxicity in End-Stage Renal Disease

JAMA  
Network | **Open**

Original Investigation | Pharmacy and Clinical Pharmacology

### Low-Dose Methotrexate and Serious Adverse Events Among Older Adults With Chronic Kidney Disease

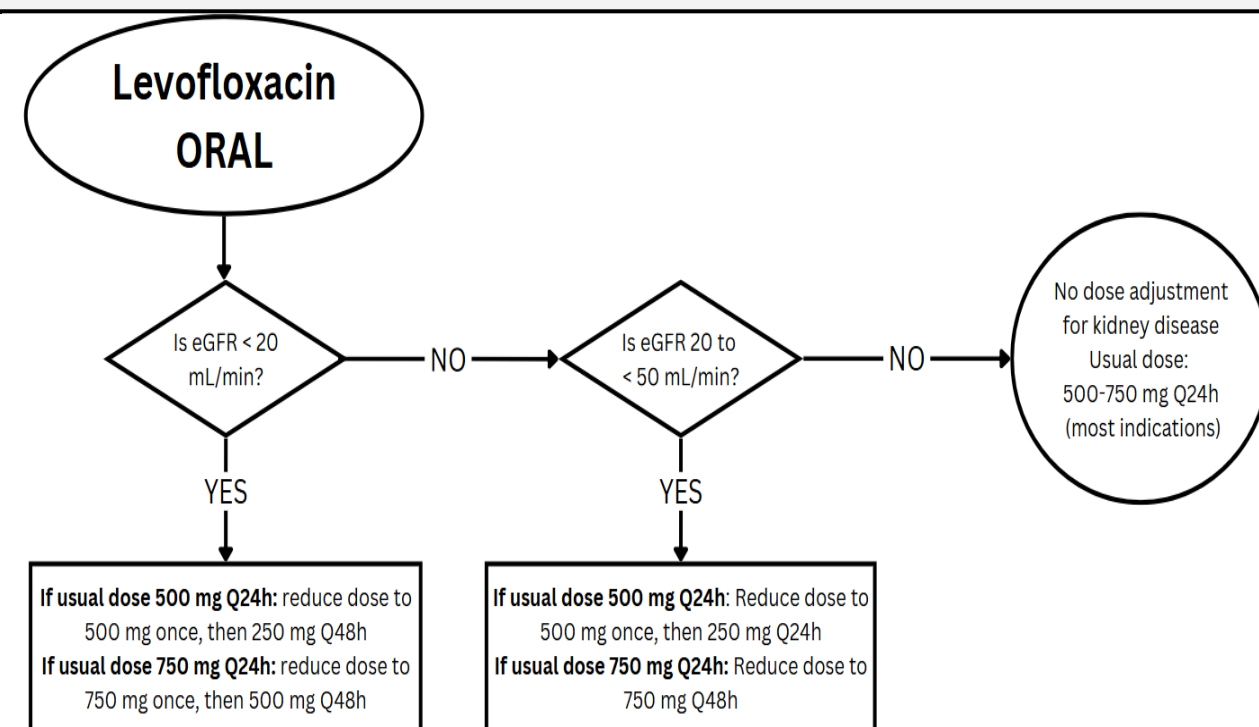
Flory T. Muanda, MD, PhD; Peter G. Blake, MB; Matthew A. Weir, MD, MSc; Fatemeh Ahmadi, PharmD; Eric McArthur, MSc; Jessica M. Sontrop, PhD; Brad L. Urquhart, PhD; Richard B. Kim, MD; Amit X. Garg, MD, PhD



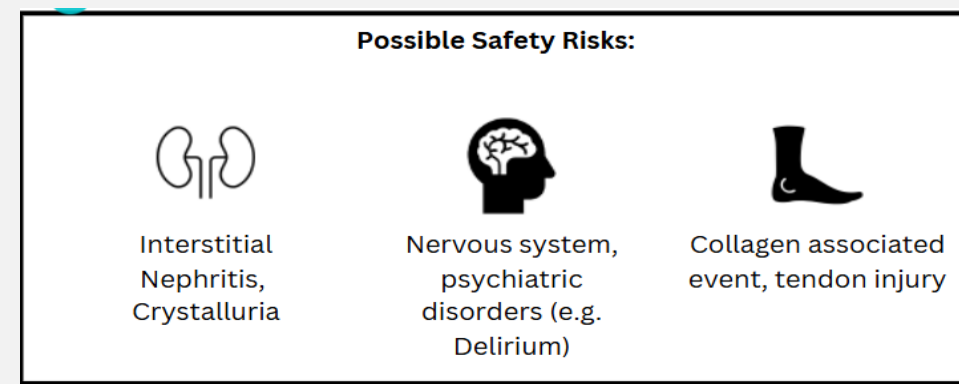
Original Investigation | Pharmacy and Clinical Pharmacology

## Association of Higher-Dose Fluoroquinolone Therapy With Serious Adverse Events in Older Adults With Advanced Chronic Kidney Disease

Flory Tsobo Muanda, MD, PhD; Manish M. Sood, MD, MSc; Matthew A. Weir, MD, MSc; Jessica M. Sontrop, PhD; Fatemeh Ahmadi, PharmD; Elisa Yoo, BMSc; Richard B. Kim, MD; Michael S. Silverman, MD; Gregory A. Knoll, MD, MSc; Amit X. Garg, MD, PhD



# Fluoroquinolones



# Case Vignette

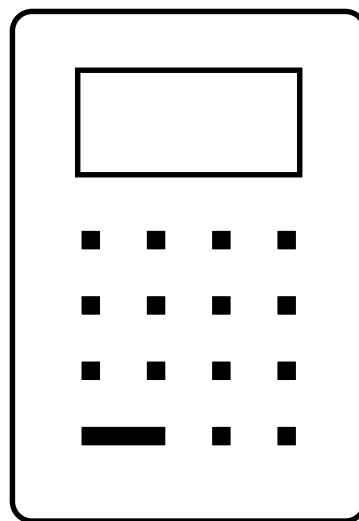


- 75-year-old female, 152 cm, 48 kg
  - Comorbidities: hypertension, CKD, T2D, Dyslipidemia
  - **Bloodwork review:** eGFR 34 ml/min/1.73m<sup>2</sup>, SCr 140 umol/L and stable
  - **Clinical review:**
    - numbness, tingling, burning sensations, pain often starting in the feet and hands
  - **Gabapentin prescribed 600 mg BID**

# Kidney Function Calculator



National Kidney Foundation GFR Calculators



## eGFR Calculator

Serum Creatinine:  ☐ mg/dL ☒  $\mu\text{mol/L}$

Serum Cystatin C:  mg/L

Age:  Years

Gender: ☐ Male ☒ Female

Standardized Assays: ☒ Yes ☐ No ☐ Not Sure

Adjust for body surface area: ☐ Yes ☒ No ☐ Not Sure

Calculate

### Results

CKD-EPI creatinine equation (2021)  mL/min/1.73m<sup>2</sup>

## eGFR Calculator

Serum Creatinine:  ☐ mg/dL ☒  $\mu\text{mol/L}$

Serum Cystatin C:  mg/L

Age:  Years

Gender: ☐ Male ☒ Female

Standardized Assays: ☒ Yes ☐ No ☐ Not Sure

Adjust for body surface area: ☒ Yes ☐ No ☐ Not Sure

Height:  ☐ Inches ☒ Centimeters

Weight:  ☐ Pounds ☒ Kilograms

Calculate

### Results

CKD-EPI creatinine equation (2021)  mL/min

# Gabapentin

eGFR < 15 ml/min

- 100-300 mg daily\*

eGFR 15 to < 30 ml/min

- 200-700 mg daily\*

eGFR 30 to < 60 ml/min

- 400-1400 mg (÷ by 2) administered BID\*

## Possible Safety Risks:



Encephalopathy,  
confusion, loss of  
consciousness



Sedation  
dizziness/falls



Respiratory  
depression

\*DEPRESCRIBE if no benefit at these doses



# Deprescribing

## Deprescribing in chronic kidney disease: An essential component of comprehensive medication management

Marisa Battistella, PharmD, ACPR ✉,  
Jo-Anne Wilson, PharmD, MEd, ACPR, Angelina Abbaticchio, MPH,  
Patrick Gee, PhD, Rasheeda Hall, MD, MBA, MHS

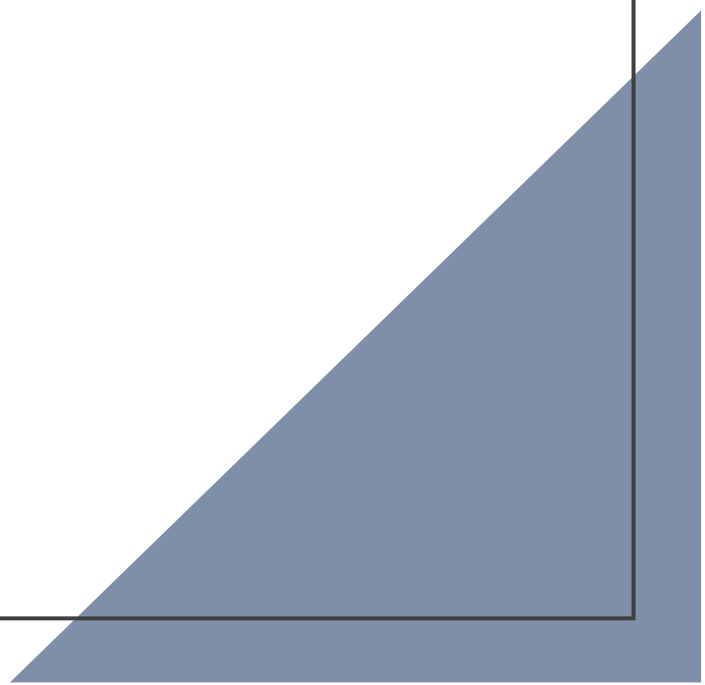
*American Journal of Health-System Pharmacy*, zxaf051,  
<https://doi.org/10.1093/ajhp/zxaf051>

**STOPMed-HD**

Strategic Optimization of Prescription Medication Use in Patients on HemoDialysis

<https://www.stopmedhd.ca/>

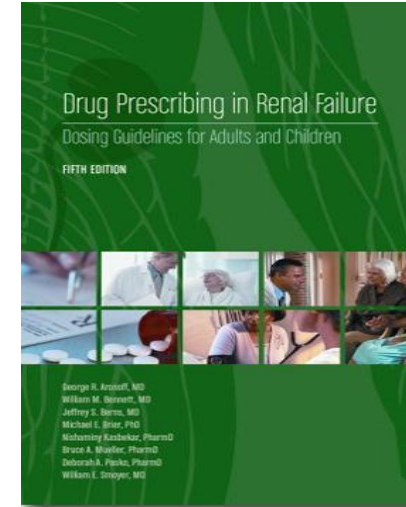
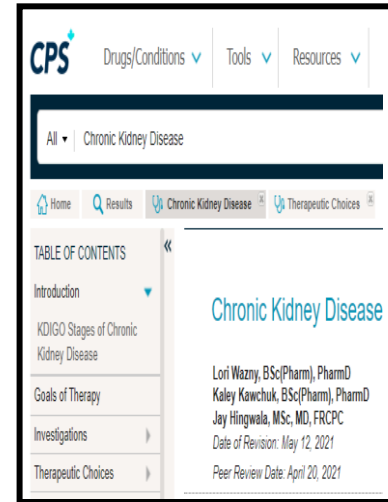
# Resources



# Drug Dosing Resources

CPS, Micromedex,  
Lexicomp

Drug Prescribing  
in Renal Failure

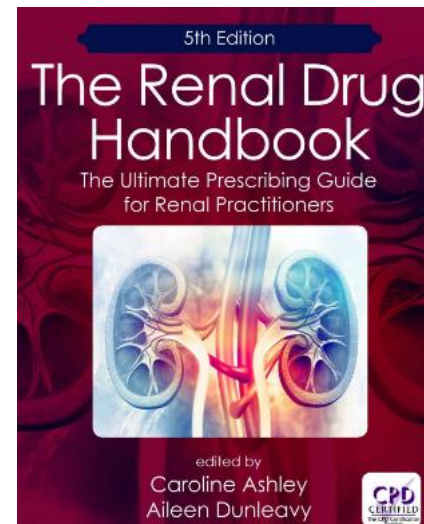
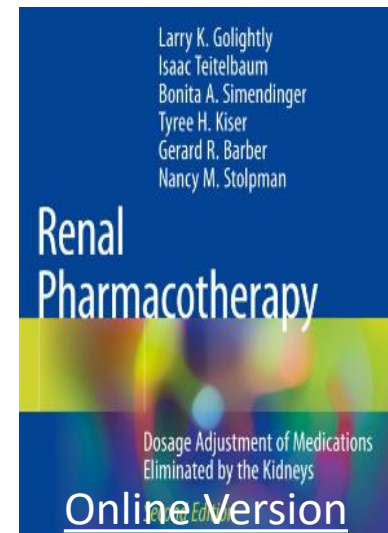


Drug monographs

Pharmacokinetic  
Studies

Firstline App

Pharmacists



Renal  
Pharmacotherapy

The Renal Drug  
Handbook

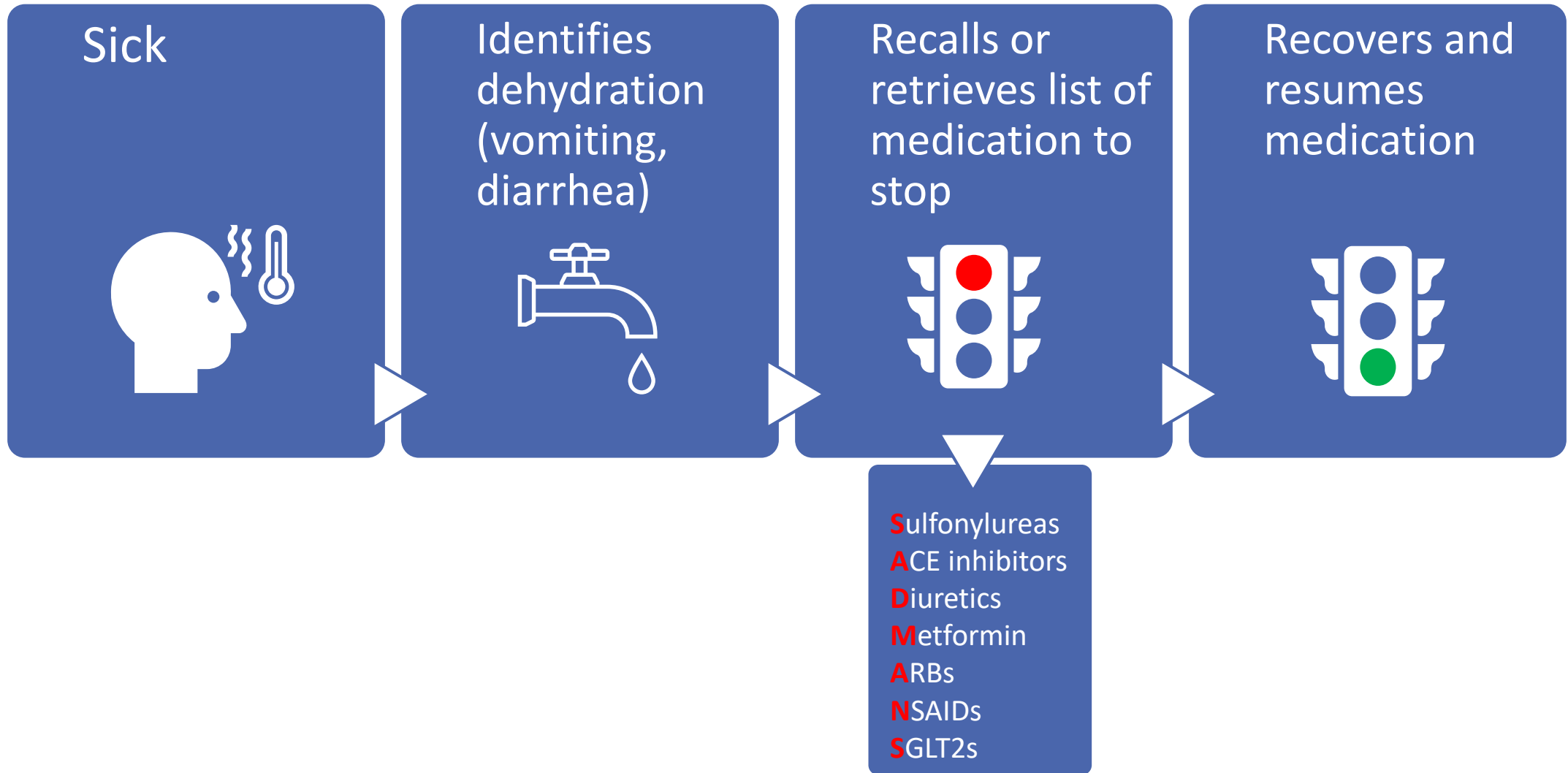
# Natural Health Products Resource



## AVOID

Aristolochic acid	Barberry	Cat's claw
Astragalus	Creatine	Goldenrod
Apium Graveolens	Huperzinea	Java Tea Leaf
Horsetail	Nettle, Stinging Nettle	Oregon Grape Root
Licorice Root	Pennyroyal	Ruta Graveolens
Parsley Root	Uva Ursi	Yohimbe

# Sick Day Medication Guidance



# Resources: People with CKD

Kidney Foundation of Canada Living with Reduced Kidney Function

Kidney Health Australia Medicine and Kidney Disease Factsheet

NKF Which Drugs are Harmful to Your KIDNEYS



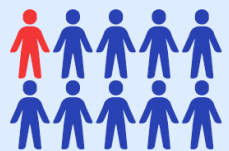
## Living with Reduced Kidney Function

6th Edition





# CHRONIC KIDNEY DISEASE MEDICATION CONSIDERATIONS FOR COMMUNITY PHARMACISTS



1 in 10 Canadians have CKD and millions more are at risk

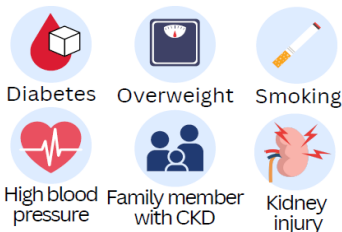


Individuals with advanced CKD take 12 or more medications

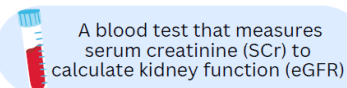


Kidneys play an important role in the removal of medications from the body

## Who is at risk of CKD?



## Testing for CKD



A blood test that measures serum creatinine (SCr) to calculate kidney function (eGFR)



A urine test that measures kidney damage (UACR)



Imaging such as an ultrasound or biopsy

## Defining CKD

Abnormalities in kidney structure, eGFR <60 ml/min/1.73m for > 3 months **AND/OR** two UACR ≥ 3 mg/mmol (3 months apart)

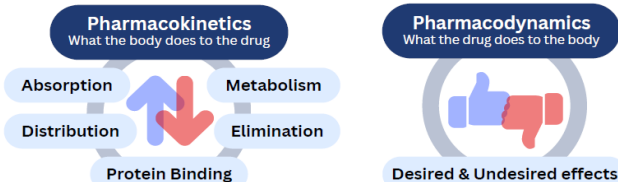
## CKD Categories and Risk Progression

eGFR categories (ml/min/1.73m <sup>2</sup> )		Albuminuria categories		
		A1	A2	A3
1	Normal to high	>90		
2	Mildly ↓	60-90		
3A	Mildly to moderately ↓	45-59		
3B	Moderately to severely ↓	30-44		
4	Severely ↓	15-29		
5	Kidney failure	<15		
		<3mg/mmol	3-29mg/mmol	>30mg/mmol

**KDIGO 2024 guidelines** <https://kdigo.org/wp-content/uploads/2024/03/KDIGO-2024-CKD-Guidelines.pdf>

Find out your patient's risk of kidney failure: **The Kidney Risk Calculator** (<https://kidneyfailurecalculator.com/>) an online tool that calculates risk of CKD based on patient-specific factors

## CKD alters...



Medication adjustment may be needed to avoid harm

## Estimate kidney function using SCr based equations

### 2021 CKD-EPI eGFR, ml/min/1.73m<sup>2</sup>

- Calculated by the lab using a standard body surface area (BSA) of 1.73m<sup>2</sup>
- Convert to **ml/min** for drug dosing using either:

$$1. \text{ eGFR (ml/min/1.73m}^2\text{)} \times \text{Individual's BSA} / 1.73 = \text{eGFR (ml/min)}$$

$$\text{BSA (m}^2\text{)} = \sqrt{\text{Height (cm)} \times \text{Weight (kg)} / 3,600}$$

- NKF eGFR Conversion to ml/min:

[https://www.kidney.org/professionals/kdqi/gfr\\_calculator](https://www.kidney.org/professionals/kdqi/gfr_calculator)

### Cockcroft-Gault Creatinine Clearance (CG CrCl), ml/min

$$\text{CrCl} = [1.2(140 - \text{age})(\text{IBW}) / \text{SCr (umol/L)}] \times 0.85 \text{ (females)}$$

$$\text{IBW men (kg)} = 50\text{kg} + (0.91 \times [\text{Height (cm)} - 152.4])$$

$$\text{IBW women (kg)} = 45.5\text{kg} + (0.91 \times [\text{Height (cm)} - 152.4])$$

### When is eGFR or CrCl unreliable?

when kidney function is unstable or at extremes of muscle mass

- Compare estimates of eGFR and CrCl in ml/min
- Check 2 trusted drug resources and compare, some may specify which equation to use
- Weigh the risks and benefits of dose adjustment
- Determine the adjusted dose and/or frequency
- Monitor response

# CHRONIC KIDNEY DISEASE MEDICATION CONSIDERATIONS FOR COMMUNITY PHARMACISTS

**2x**  
**ADRs**

Adverse drug reactions (ADRs) are about twice as common when eGFR drops below 30

## Common medications to dose-adjust or avoid (if eGFR <30)

Metformin	AmoxiClav
Glyburide	Levofloxacin
Sitagliptin	Ciprofloxacin
Rosuvastatin	TMP/SMX
Fibrates	Fluconazole
Allopurinol	Nitrofurantoin
Colchicine	Apixaban
Gabapentin	Rivaroxaban
Pregabalin	Edoxaban
NSAIDs	Dabigatran
Morphine	Duloxetine
Coideine	Escitalopram
Baclofen	Venlafaxine
Tramadol	Lithium
Acyclovir	Famotidine
Valacyclovir	Ranitidine
Famciclovir	Digoxin
Oseltamivir	Methotrexate

Over-the-counter (OTC) medications can be harmful and some can even damage the kidneys



Vitamins / Supplements

- potassium, magnesium
- high dose vitamin A or C



NSAIDs

- ibuprofen, naproxen
- cold and flu products with NSAIDs



Natural Health Products

- ingredient list may not be accurate

### Use with caution

may contain diuretics, potassium or other ingredients which can affect the kidneys or interact with other medications. **Herbal CKD**

<https://www.herbalckd.com/?page=home>



### Top Tips

- Educate patients that having CKD can affect drug dosing.
- Educate patients about medication benefits and possible risks so they can be identified and managed early.
- Do medication reviews regularly.
- Order a SCr if one is not available to estimate kidney function for **drug dosing**.
- Convert lab eGFR to ml/min** and/or calculate CrCl for drug dosing.
- Provide sick day medication guidance to reduce the risk of acute kidney injury.

**THINK medications as kidney function declines!**

## Sick Day Medication Guidance

To prevent acute kidney injury, advise patients to **temporarily stop** certain medications when they are unable to keep food or fluid down.

## Medications to hold:

Sulfonylureas

ACE inhibitors

Diuretics

Metformin

ARBs

NSAIDs

SGLT2s

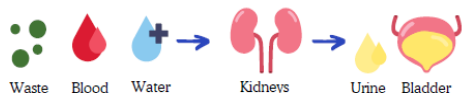
Advise patients to **restart** medications when symptoms have resolved and returned to normal eating and drinking



# Chronic Kidney Disease: Using Medications Safely

## What are kidneys?

You have 2 bean-shaped kidneys about the size of your fist. They are under your ribcage with 1 on each side of your spine. Each kidney has millions of tiny filters called **nephrons**. These nephrons clean your blood. They get rid of extra water and waste that your body does not need and turn it into urine.



## What else do your kidneys do?

Your kidneys get rid of some medications from the body, help to make red blood cells, and play an important role in blood pressure and bone health.



## What is Chronic Kidney Disease (CKD)?

Chronic kidney disease (also called CKD) is when you have kidney damage that happens **slowly** over time. This means your kidneys no longer clean your blood as well as they used to. If your kidneys are damaged, they may leak a type of protein into your urine.

### CKD Categories using eGFR

G1	90 ml/min/1.73m <sup>2</sup> or higher
G2	60-89 ml/min/1.73m <sup>2</sup>
G3a	45-59 ml/min/1.73m <sup>2</sup>
G3b	30-44 ml/min/1.73m <sup>2</sup>
G4	15-29 ml/min/1.73m <sup>2</sup>
G5	15 ml/min/1.73m <sup>2</sup> or lower

CKD = Chronic Kidney Disease; eGFR = estimated Glomerular Filtration Rate; UACR = urinary albumin creatinine ratio



## How is CKD Diagnosed?

A blood test that measures kidney function (eGFR)

A urine test that measures kidney damage (UACR)

Imaging such as an ultrasound or biopsy

## What are the symptoms of CKD?

People with early CKD may not feel sick or have any symptoms until they have lost most of their kidney function.

Symptoms of CKD may include:

- nausea, low appetite
- weight loss, poor sleep
- feeling tired, itchy skin
- swollen feet, bone pain
- changes in your urine



1 in 10 people in Canada have CKD

# Using Medications Safely in CKD

## Why is medication safety important if you have CKD?

People with CKD often take many medications. You may take these medications to slow down your kidney damage or to help with other conditions, like high blood pressure or diabetes.

Your kidneys may not be able to get rid of medications as well as they used to. These medications may build up in your body and cause side effects or even damage your kidneys.



## How can I make sure my medications are OK for my level of kidney function?

### Ask your pharmacist...



if your new medication is safe for you

OR

for a medication review to check if the dose is right for you

If your medication is not safe for your level of kidney function, your pharmacist or healthcare provider can lower the dose or change to a safer medication.

## How do I manage my medications if I get sick?

If you become dehydrated because of diarrhea, vomiting or low appetite, you may need to stop taking some of your medications for a short time; even if they are helping to slow your CKD.



**Remember** to start taking these medications again once you are back to your usual eating and drinking. Talk with your pharmacist or healthcare provider about which medications you may need to briefly stop if you become sick.

## Over-the-counter (OTC) medications

If you have CKD, OTC medications can build up in your body. Some may even damage your kidneys. Always check with your pharmacist before taking any OTC medications:



vitamins / supplements



non-steroidal anti-inflammatory drugs like ibuprofen



natural health products

## Helpful tips:

- Tell all healthcare providers that you have CKD. **Do not assume they know.**
- Ask a pharmacist to review your medications to ensure they are safe.
- Ask a pharmacist to help choose an OTC medication that is safe for you.
- Go to the same pharmacy, the staff will get to know you and your CKD.
- Ask which medications need to be temporarily stopped while you're sick and when you can restart them.



Scan here to watch video!

## Medication Safety Video



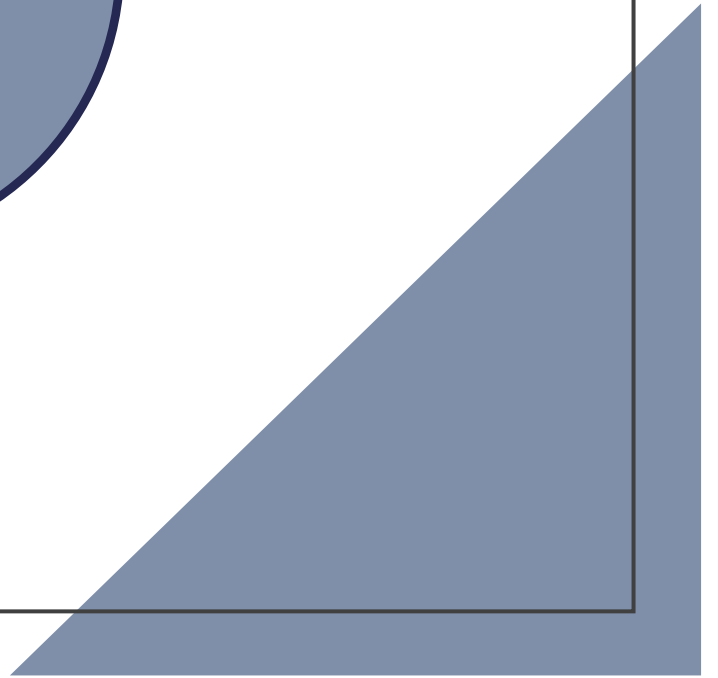




# Key Concepts for CKD Drug Stewardship

Encourage	patients to inform all prescribers they have CKD
Educate	patients that having CKD can affect medication dosing
Explain	medication benefits and possible risks so they can be identified and managed early
Assess	Kidney function for drug dosing decision
Convert	lab eGFR to mL/min (over or underweight)
Provide	sick day medication guidance
THINK	medications as kidney function declines

Questions or  
Comments



# Please Complete an Evaluation

<https://forms.office.com/r/hL8ha6mQh4>

Medication Safety and Drug  
Dosing in People with Chronic  
Kidney Disease Evaluation

