SAFE MEDICATION USE IN PATIENTS WITH IMPAIRED RENAL FUNCTION

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Faculty/Presenter Disclosure

Faculty: Dr. Allan Grill

I have the following relevant financial relationships to disclose:

- Consultant for: CCO – Ontario Renal Network
- Relationships with commercial interests:
  - Not Applicable
Disclosure of Commercial Support

• This program has received NO Commercial support
• This program has received NO in-kind support

• Potential for conflict(s) of interest:
  • Not Applicable
Remembrance Day

Lest We Forget

Ontario Renal Network

Kidney Wise
Detect + Protect
Tweet Tweet

- @allan_k_grillMD
- #myFMF
Learning Objectives

• To recognize common causes of adverse drug reactions (ADRs)
• To appreciate common medication prescribing challenges in patients with chronic kidney disease (CKD), including LTC settings
• To propose innovative solutions in primary care that promote improved medication prescribing practices for patients with CKD/impaired renal function
About the Ontario Renal Network

- Responsible for overseeing and funding the delivery of chronic kidney disease (CKD) services across Ontario
- A ‘network’ of all the kidney care programs in Ontario
- Early detection and prevention of progression of CKD in the primary care setting is a main priority
- Ontario Renal Plan II is a roadmap that outlines how the Ontario Renal Network (ORN) will try to improve the lives of those living with CKD
Accessing KidneyWise Toolkit

kidneywise.ca

Print
Online
App
Prevalence of CKD

- Abnormality in kidney structure or function, present for > 3 months
  - eGFR < 60; urine ACR > 3 (2 out of 3 samples)
- 10% of North Americans have CKD
  - 26 million people
- 25% of North Americans > age 65 have CKD
- Only 3% of CKD patients progress to ESRD
### GFR Categories in CKD

1.2.3: Assign GFR categories as follows *(Not Graded)*:

<table>
<thead>
<tr>
<th>GFR category</th>
<th>GRF (ml/min/1.73m²)</th>
<th>Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>≥ 90</td>
<td>Normal or high</td>
</tr>
<tr>
<td>G2</td>
<td>60 - 89</td>
<td>Mildly decreased*</td>
</tr>
<tr>
<td>G3a</td>
<td>45 - 59</td>
<td>Mildly to moderately decreased</td>
</tr>
<tr>
<td>G3b</td>
<td>30 - 44</td>
<td>Moderately to severely decreased</td>
</tr>
<tr>
<td>G4</td>
<td>15 - 29</td>
<td>Severely decreased</td>
</tr>
<tr>
<td>G5</td>
<td>&lt;15</td>
<td>Kidney failure</td>
</tr>
</tbody>
</table>

*Relative to young adult level.

In the absence of evidence of kidney damage, neither GFR category G1 nor G2 fulfill the criteria for CKD.

KDIGO CKD Guidelines, 2012
Adverse Drug Reaction (ADR)
Case 1

- 85 year old male with DM and stable CKD (stage 4; eGFR 28); lives in a nursing home
- Presents to their primary care provider (PCP) with shingles, started on Valacyclovir (Valtrex) 1g tid
- 2 days later – presents with delirium, agitation requiring neuroleptics to control
- Recommended dose (eGFR < 30) – 1g daily
Case 2

- 76 year old female with CKD (eGFR 35).
- Ongoing issues with lower back pain - started on baclofen by PCP after trial of Tylenol ineffective
- The following day, presents with confusion followed by stupor – sent to the ER. Subsequently develops NSTEMI in hospital and dies


*Reduced level of consciousness from baclofen in people with low kidney function.*

Su W¹, Yegappan C, Carlisle EJ, Clase CM.
Case 3

- 83 year old male with CHF, HTN and CKD (creatinine 180; eGFR 35) on ramipril 5 mg daily
- Admitted to hospital for a CHF exacerbation and started on spironolactone - stabilized
- 2 weeks after discharge, PCP checks eGFR/electrolytes, and stops spironolactone due to elevated potassium level. Furosemide started prn while awaiting cardiology follow-up
- 1 month later, patient is admitted to ortho after a fall for R hip # surgery, and gets discharged 5 days later on spironolactone in addition to his other medications

- Presented to ER 5 days later with leg weakness. Creatinine 350, eGFR 16, K 7.8
Institute of Medicine - 1999

• 44,000-98,000 deaths in US due to medical errors; 1 million injuries

• 7,000 deaths annually in the U.S. due to medication errors alone
Nobody’s Perfect

2.5 billion outpatient Rxs;
3.75 billion inpatient drug orders
Adverse Drug Reaction (ADR)

• An undesirable effect of a drug beyond its anticipated therapeutic effects occurring during clinical use (WHO definition)

• 3-6% of all hospital admissions relate to medication adverse events (100,000/year); 700,000 ER visits

• 1 in 200 seniors hospitalized for a drug adverse reaction (Canada, 2010-2011)
  • 5x the rate of younger adults
  • Increases LOS by 3.15 days
  • Cost implications - $3,400/hospital admission

• 5% prescribing error in primary care (UK data)
• Frailty
  • Physiological changes (liver; body mass)
  • Affects drug metabolism; distribution of lipophilic/lipophobic drugs; elimination
  • Progressive decline involving multiple body systems
  • Chronological age may not accurately reflect function
• RCTs may not be generalizable to all (e.g. elderly patients; advanced CKD)
  • ‘Treat to target’ may cause more harm than benefit
ADRs – Causes/Considerations

• Polypharmacy → prescribing cascade → drug-drug interactions

• Estimated 2/3 of ambulatory patients over age 60 are taking ≥ 4 meds/day
• Quality of Life
• Time to benefit (T2B) > estimated life expectancy
• Goals of Care (e.g. dementia)
  • Shared decision making
• Individual patient preference
• Is QOL improving?
ADRs – Causes/Considerations

• Allergies
ADRs – Causes/Considerations

- CKD/impaired renal function

- Medication dosing requires special attention – many are metabolized/cleared by the kidneys – increases risk

- Polypharmacy is typical given increased age and complex comorbidities – increased risk of drug interactions
ADRs – Causes/Considerations

• 25-30% of patients when admitted to hospital have CKD (eGFR<60)
  • ↑ exposure to medications

• Check dose; contraindication?
  • Calculate CrCl
  • Check eGFR
  • Drug index (e.g. CPS)
ADRs – Causes/Considerations

- Estimated that 19%-69% of meds prescribed to patients with renal impairment contain dosing errors
  - Farag et al. AJKD 2014

- Up to 20% of hospital admissions due to AKI have been attributed to Drug Induced Nephrotoxicity
  - Elasy et al. Semin Dial 1996
• 7904 patients admitted to hospital in U.S. over 8 months
• 14% of medication orders were nephrotoxic or required dose alteration based on patient’s renal function
CKD – Outpatient Medication Errors

• **Outpatient setting:** antibiotics are the most common cause of ADRs among seniors

• **Study** - frequency of excess dosing in CKD patients (eGFR < 30) not on dialysis; 2 years; southwestern ON

• 66% of Rxs were dosed in excess of recommendations

• Nitrofurantoin was prescribed incorrectly 100% of the time

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Table 3. Total Prescriptions and Dosing Errors for Study Antibiotics

<table>
<thead>
<tr>
<th>Medication</th>
<th>Total Prescriptions</th>
<th>Dosing Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciprofloxacin</td>
<td>271</td>
<td>147 (54)</td>
</tr>
<tr>
<td>Cefixime</td>
<td>11</td>
<td>9 (82)</td>
</tr>
<tr>
<td>Cefprozil</td>
<td>114</td>
<td>70 (61)</td>
</tr>
<tr>
<td>Cephalexin</td>
<td>425</td>
<td>258 (61)</td>
</tr>
<tr>
<td>Clarithromycin</td>
<td>251</td>
<td>130 (52)</td>
</tr>
<tr>
<td><strong>Nitrofurantoin</strong></td>
<td><strong>169</strong></td>
<td><strong>169 (100)</strong></td>
</tr>
<tr>
<td>Sulfamethoxazole-trimethoprim</td>
<td>214</td>
<td>185 (86)</td>
</tr>
<tr>
<td>Dicyclomine</td>
<td>9</td>
<td>2 (22)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,464</strong></td>
<td><strong>970 (66)</strong></td>
</tr>
</tbody>
</table>

Farag et al. AJKD 2014
Further analysis

N = 564 physicians

Canadian medical graduates and family physicians may be at increased risk of dosing errors

Farag et al. AJKD 2014
Drug Dosing Errors

• So why are we making so many drug dosing errors in patients with CKD/impaired renal function?
Assessment of Kidney Function

• Calculated GFR approximations

  • CrCl by Cockcroft-Gault formula

  • eGFR by MDRD formula (Modification of Diet in Renal Disease)

  • eGFR by CKD EPI formula (Chronic Kidney Disease Epidemiology Collaboration)
Cockroft-Gault Formula  →  CrCl

\[
\text{CrCl (ml/min)} = \frac{(140 - \text{age}) \times \text{wt} \times 1.23 \times (0.85 \text{ if female})}{72 \times \text{Scr (mg/dL)}}
\]

- 1976 – CG formula developed to estimate creatinine clearance (CrCl) in men; adjustment added for women
- Serum creatinine measurement not standardized across labs at the time
- Imprecise measure of glomerular filtration rate (GFR)
  - Lower estimation than actual GFR
  - Less accurate at older ages; variation in muscle mass, body size – not adjusted for body surface area
The MDRD & CKD-EPI Formulas \(\rightarrow\) eGFR

- eGFR (ml/min/1.73m\(^2\)) – different units than CG
- MDRD = \(32788 \times Cr^{-1.154} \times age^{-0.203} \times constant\)
- constant = 1 (white males); 0.742 for females; 1.21 for African Americans
- CKD-EPI = \(141 \times \min(S_{cr}/k, 1)^{\alpha} \times \max(S_{cr}/k, 1)^{-1.209} \times 0.993^{\text{Age}} \times 1.018 \ [\text{if female}] \times 1.159 \ [\text{if black}]\)
- CKD-EPI formula replaced MDRD – still limited re: extremes in size given chosen ‘constants’
- www.nkdep.nih.gov (online calculator)
<table>
<thead>
<tr>
<th>SCr</th>
<th>Gender</th>
<th>Age</th>
<th>IW</th>
<th>CG (ml/min)</th>
<th>MDRD (ml/min/1.73m²)</th>
<th>CKD EPI (ml/min/1.73m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>130</td>
<td>M</td>
<td>40</td>
<td>70</td>
<td>66.1</td>
<td>56</td>
<td>59</td>
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<tr>
<td>130</td>
<td>M</td>
<td>80</td>
<td>60</td>
<td>34</td>
<td>49</td>
<td>44</td>
</tr>
<tr>
<td>130</td>
<td>F</td>
<td>80</td>
<td>50</td>
<td>24.1</td>
<td>37</td>
<td>33</td>
</tr>
</tbody>
</table>
Cases

• Which formula should be used to make drug dosing decisions?
Measuring Kidney Function

• Despite the limitations of all 3 formulas…

• 1998 – FDA recommends pharma industry use CG formula to estimate GFR when designing pharmacokinetic studies & drug dosing guidelines

• 2017 – labs in Canada have standardized serum creatinine assays and are using the CKD-EPI formula for estimating GFR; international consensus that CKD-EPI is more accurate than CG (including the National Kidney Foundation)

• Yet many product labels, and physicians, still use CG formula for drug dose adjustments
Measuring Kidney Function

• So why is this even important?
• Accurate estimates of kidney function are essential for optimal dosing of drugs cleared by the kidney
• If kidney function overestimated → inappropriate large doses → toxicity
• If kidney function underestimated → sub-therapeutic dosing → treatment failure → prolonged illness

- 5,500 patient database
- Studies measured GFR (mGFR) using gold standard urinary clearance method
- Kidney function estimated using CG & MDRD adjusted for BSA (ml/min)
- Measured concordance between mGFR vs. MDRD/CG
  - 78% vs. 73%
- Drug simulation study (15 drugs)
  - Commonly used
  - Renally cleared
  - Associated w/ dosing errors/ADRs

<table>
<thead>
<tr>
<th>Table 3. Concordance Between Kidney Function Categories Assigned Using mGFR Versus Estimated Kidney Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equation</td>
</tr>
<tr>
<td>MDRD Study</td>
</tr>
<tr>
<td>CG</td>
</tr>
<tr>
<td>CG_{IBw}</td>
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</table>
Comparing Estimates in Drug Dosing

Concordance in dosing recommendations

<table>
<thead>
<tr>
<th>Estimation Method</th>
<th>Concordant (%)</th>
<th>Discordant (&lt; mGFR)</th>
<th>Discordant (&gt; mGFR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDRD Study</td>
<td>88</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>CG</td>
<td>85</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>CG-IBW</td>
<td>82</td>
<td>13</td>
<td>4</td>
</tr>
</tbody>
</table>

## Comparing Estimates in Drug Dosing

Concordance in dosing recommendations

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<th>Estimation Method</th>
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<tr>
<td>CG-IBW</td>
<td>82</td>
<td>13</td>
<td>4</td>
</tr>
</tbody>
</table>

Comparing Estimates in Drug Dosing

• In most drug dosing situations in outpatient primary care for patients with CKD/impaired renal function, using serum eGFR as a reference is safe and acceptable.

• In situations when patients are very sick, have extremes in body mass (obese vs. thin/frail), or medication chosen has high toxicity – order a 24 hr. urine for the most accurate estimation of GFR.
Potential Interventions - prescriber

- One might hypothesize that eGFR reporting would reduce prescribing errors in CKD
  - More awareness of CKD
- Initiation of eGFR reporting not associated with a decline in rate of antibiotic dosing errors
- Knowledge gap
  - ? Not looking for CKD

Farag et al. AJKD 2014
Drug prescribing errors in CKD

- Prescribing physician may not have known patient had low kidney function ➔ KidneyWise
Scope of the problem

- Number of medications available in Canada to lower glucose levels in patients with diabetes
Quiz!

• Which of these drugs is **least** dependent on renal elimination?
  a) Digoxin
  b) Gabapentin
  c) Ranitidine
  d) Enalapril
Quiz!

• Which of these drugs is least dependent on renal elimination?
  a) Digoxin
  b) Gabapentin
  c) Ranitidine
  d) Enalapril
# Drug prescribing errors in CKD

<table>
<thead>
<tr>
<th>Drug</th>
<th>% excreted extrarenally</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digoxin</td>
<td>30</td>
</tr>
<tr>
<td>Ranitidine</td>
<td>20</td>
</tr>
<tr>
<td>Lisinopril</td>
<td>20</td>
</tr>
<tr>
<td>Dabigatran</td>
<td>20</td>
</tr>
<tr>
<td>Fampciclovir</td>
<td>14</td>
</tr>
<tr>
<td>Atenolol</td>
<td>12</td>
</tr>
<tr>
<td>Enalapril</td>
<td>10</td>
</tr>
<tr>
<td>Acyclovir</td>
<td>10</td>
</tr>
<tr>
<td>Allopurinol</td>
<td>10</td>
</tr>
<tr>
<td>Lithium</td>
<td>2</td>
</tr>
<tr>
<td>Gabapentin</td>
<td>2</td>
</tr>
</tbody>
</table>
Drug prescribing errors in CKD

Medications that require dose adjustment in CKD

- Acyclovir
- Baclofen
- Cimetidine
- Cipro
- Cephalexin
- Digoxin
- Dabigatran
- Dikaline
- Nitrofurantoin
- Allopurinol
- Atanolol
- Ranitidine
- NSAIDs

Toxicity in CKD when prescribed incorrectly

Prescribing frequency
Drug prescribing errors in CKD

• Prescribing physician may not have known patient had low kidney function → KidneyWise

• Prescribing physician may not have known that the drug required a dose adjustment
ORN - CKD Safe Medication List

- It is difficult for PCPs to easily access a list of commonly prescribed, potentially harmful medications in those patients with CKD or ESRD.

- The development of such a list would contribute to an effective strategy to reduce and prevent harm to patients with CKD.
Overview of Approach

1. Literature Review
2. Modified Delphi Panel
3. Knowledge Translation

Note: this study received ethics approval from the Hamilton Integrated Research Ethics Board
Initial Literature Search
=871 articles

116 articles

Medications identified from articles + experts
=148 medications

755 articles were excluded due to:
- Not related to CKD/ESRD
- Alternative medicine studies
- Animal studies
- Not approved in Canada
- Case Series/Case Reports
- Editorials/Letters

89 medications excluded based on:
- Prescription frequency
- Availability in Canada
- Compendium of Pharmaceuticals and Specialties (CPS) dosing recommendations

59 medications
Modified Delphi Study Panel

<table>
<thead>
<tr>
<th>Number of Experts =17</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Geographic distribution</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ontario</td>
<td>12</td>
<td>71</td>
</tr>
<tr>
<td>British Columbia</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Alberta</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td><strong>Specialties</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pharmacists</td>
<td>5</td>
<td>29</td>
</tr>
<tr>
<td>Nephrologists</td>
<td>5</td>
<td>29</td>
</tr>
<tr>
<td>Internists/Pharmacologists</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Emergency Department Physicians</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Nurse Practitioners</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Medication Safety Specialists</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Primary Care Physicians</td>
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<tr>
<td><strong>Gender</strong></td>
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<td>Male</td>
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<tr>
<td>Female</td>
<td>7</td>
<td>41</td>
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Example of CKD Medication Safety Questionnaire

Acetaminophen should be adjusted at the following eGFR values

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Somewhat disagree</th>
<th>Somewhat agree</th>
<th>Strongly agree</th>
<th>N/A</th>
</tr>
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<tbody>
<tr>
<td>45-59</td>
<td></td>
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</tr>
<tr>
<td>30-44</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>15-29</td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>&lt;15</td>
<td></td>
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<tr>
<td>&lt;15</td>
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</tbody>
</table>

Please provide any additional comments here

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CCA Ontario Renal Network
Modified Delphi Process Chart

Round 1: Electronic Survey

Round 2: Facilitated Discussion and Survey

Round 3: Electronic Survey

Consensus or Decision Point Reached

Results analyzed and sent back to panel

Results analyzed and sent back to panel

Final Results; Medication List Developed
## Results: Recommended draft list of medications to be AVOIDED

<table>
<thead>
<tr>
<th>eGFR &lt;45</th>
<th>eGFR &lt;30</th>
<th>eGFR &lt;15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dapagliflozin</td>
<td>Canagliflozin</td>
<td>Apixaban</td>
</tr>
<tr>
<td>Dabigatran</td>
<td>Baclofen</td>
<td></td>
</tr>
<tr>
<td>Empagliflozin</td>
<td>Bisphosphonates</td>
<td></td>
</tr>
<tr>
<td>Glyburide</td>
<td>Duloxetine</td>
<td></td>
</tr>
<tr>
<td>Metformin</td>
<td>Edoxaban</td>
<td></td>
</tr>
<tr>
<td>Nitrofurantoin</td>
<td>Fibrates</td>
<td></td>
</tr>
<tr>
<td>Ribavirin</td>
<td>Rivaroxaban</td>
<td>Saxagliptin</td>
</tr>
</tbody>
</table>

**eGFR:** estimated glomerular filtration rate.
Results: Recommended draft list of medications to be DOSE-ADJUSTED

<table>
<thead>
<tr>
<th>Medication</th>
<th>eGFR 45-59</th>
<th>eGFR 30-44</th>
<th>eGFR 15-39</th>
<th>eGFR &lt;15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amantadine</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Digoxin</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Famciclovir</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Gabapentin</td>
<td></td>
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<td>Metoclopramide</td>
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ORN - CKD Safe Medication List

- Reduce the risk of ADRs/ADEs in patients with CKD and/or impaired kidney function by:
  
  o Adjusting the dose of particular drugs used routinely in primary care practice
  
  o Avoiding the use of particular drugs common to primary care practice
Potential interventions – clinical decision support

- Could EMR systems help prevent medication errors?
- Vanderbuilt University Hospital – 598 inpatients
- Chose 122 nephrotoxic/renally cleared meds
- Passive: non-interactive message on EMR Rx order interface
- Warnings sent to MD if sCr level \( \uparrow \) by 0.5mg/dL w/in 48 hrs.
- Active: interruptive alert that required the ordering MD to:
  - Modify or discontinue the order
  - Mark the order as correct – remain unchanged
  - Defer the alert – will reappear at next log-in

McCoy et al. AJKD 2010
Potential interventions – clinical decision support

McCoy et al. AJKD 2010
Potential interventions – clinical decision support

McCoy et al. AJKD 2010
Potential interventions – clinical decision support

McCoy et al. AJKD 2010
Potential interventions – clinical decision support

EMR clinical decision support can reduce incorrect drug selection and dosing errors in patients with renal impairment

McCoy et al. AJKD 2010
Drug prescribing errors in CKD

• Prescribing physician may not have known patient had low kidney function → KidneyWise

• Prescribing physician may not have known that the drug required a dose adjustment

• Physician may have over-ridden alert for adjustment/contraindication for low eGFR
Potential interventions - pharmacist

- Provide the pharmacist with the necessary info re: patient’s kidney function via EMR

- Access to OLIS (Ontario Laboratories Information System)
Drug prescribing errors in CKD

• Prescribing physician may not have known patient had low kidney function → KidneyWise

• Prescribing physician may not have known that the drug required a dose adjustment

• Physician may have over-ridden alert for adjustment/contraindication for low eGFR

• Pharmacist who filled prescription may not have known patient had a low eGFR
Potential interventions - patient

• Provide/create educational resources for patients so they can advocate on their own behalf.
Drug prescribing errors in CKD

- Prescribing physician may not have known patient had low kidney function → KidneyWise
- Prescribing physician may not have known that the drug required a dose adjustment
- Physician may have over-ridden alert for adjustment/contraindication for low eGFR
- Pharmacist who filled prescription may not have known patient had a low eGFR
- Patient did not have information on hand to advocate on their own behalf
Potential interventions

**CHEMISTRY**

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Consistent with severe chronic kidney disease
Potential interventions

• Make resources more readily available for PCPs advising them re: prescribing in CKD

• Integrate sensible alerts into EMR prescribing systems based on level of kidney function

• Develop ways to ensure a patient’s pharmacy has the necessary info regarding a patient’s level of kidney function

• Provide patients with information on important medications that may require dosing changes or discontinuation
Med Reviews - Essential

- Periodic health exam
- New patients/admissions
- Support meetings with pharmacy
- Cross reference diagnosis list and medication list
  - Deprescribe
- Consider annual eGFR
- SADMANS – Diabetes Canada
Choosing Wisely Canada

BYE-BYE, PPI.
A toolkit for deprescribing proton pump inhibitors in EMR-enabled primary care settings

LESS SEDATIVES FOR YOUR OLDER RELATIVES.
A toolkit for reducing inappropriate use of benzodiazepines and sedative-hypnotics among older adults in hospitals
Drug Safety Information

MedEffect Canada
Together we can improve health product safety
Adverse Reactions to Drugs and Other Health Products
Get Informed!
Keep Informed!
Report Adverse Reactions.

www.healthcanada.gc.ca/medeffect
Resources

• Rx files

• The STOPP/START criteria
  • Screening Tool of Older Persons’ potentially inappropriate Prescriptions
  • Screening Tool to Alert doctors to Right Treatment

• www.deprescribing.org
• www.medstopper.com
Conclusions

• Medication prescribing errors are common in patients with CKD and are potentially harmful
• Many medications commonly prescribed in primary care require dose adjustment in CKD
• eGFR is a sensible measure to assess level of kidney function in the context of medication dosing in the majority of cases
  • Severity of illness, extremes of body mass, drug toxicity
• Integrated electronic patient-level information on level of kidney function between prescribers and pharmacists reduces errors
• Medication reviews should be performed at regular intervals with particular attention to dose adjustments in patients with renal impairment to prevent Adverse Drug Reactions
## Acknowledgments

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
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<tbody>
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Questions?

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