

**Safe Prescribing in the Older Adult**

Presented by:  
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**Disclosures**

- Speaker Bureau
  - Sanofi-Pasteur, Merck, Pfizer, Moderna, and Seqirus– Vaccines
  - AbbVie and Biohaven – Migraines
  - Idorsia – Insomnia
  - Exact Sciences: Colorectal Cancer
  - AstraZeneca: Asthma and COPD
- Consultant
  - Sanofi-Pasteur, Merck, Pfizer, Moderna, and Seqirus – Vaccines
  - Idorsia – Insomnia
  - Shield Therapeutics – Iron Deficiency Anemia

All relevant financial relationships have been mitigated

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**Objectives**

- At the end of this presentation, the participant will be able to:
  1. Discuss the differences in pharmacokinetics in the older adult vs. the younger adult.
  2. Review tips for safe prescribing in the older adult.
  3. Discuss malpractice cases which involve adverse reactions to medications in the older adult.

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**Tips**



- References
  - Listed at the end of the presentation

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**Statistics**

- We are an aging society.
  - 1 in every 5 adults is ≥65 years of age. (2020)
- Older adults consume 45% of all medications and at least 40% or more of all OTC medications.
  - 63% of older adults are taking herbal or dietary supplements.
- One in six older adults (aged 65 years and older) will have a significant adverse reaction to one or more medication.<sup>1,2</sup>

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### Statistics (continued)

- The average older adult fills 11 different medications annually.

- One study – Medicare beneficiaries discharged from a hospital to skilled nursing facility were on an average of 14 different medications.<sup>1,2</sup>

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### Prescribing in the Older Adult

- Requires special considerations because...
  - Many drug trials do not include older adults.
    - Older adults often have significant medical comorbidities which exclude them from clinical trials.
  - Older adults are often on multiple medications, including OTC supplementation.
  - Older adults often have age-related changes in pharmacokinetics (i.e., absorption, distribution, metabolism, and excretion).
  - Older adults often have age-related changes in the pharmacodynamics of a medication (the physiologic effects of the drug).<sup>2</sup>

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### Definitions

- |  |   |
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| <ul style="list-style-type: none"> <li>• Pharmacodynamics           <ul style="list-style-type: none"> <li>▪ What the drug does to the body</li> <li>▪ While the mechanism of action for the drug doesn't change, the body's responsiveness to a drug does change.               <ul style="list-style-type: none"> <li>• Adverse effects are often greater in the elderly.</li> </ul> </li> <li>▪ HMG-CoA reductase inhibitor or beta blockers</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• Pharmacokinetics           <ul style="list-style-type: none"> <li>▪ What the body does to the drug</li> <li>▪ This does change with age for a variety of reasons such as absorption, distribution, and excretion.</li> </ul> </li> </ul> |
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**How are older adults different?  
Why are medications an issue?**

<ul style="list-style-type: none"><li>• The older adult may experience an increased volume of drug distribution due to an increase in body fat relative to skeletal muscle with aging.</li></ul>	<ul style="list-style-type: none"><li>• Drug clearance may be decreased due to the natural decline in renal function with age, even in the absence of renal disease.</li></ul>	<ul style="list-style-type: none"><li>• Larger drug storage reservoirs and decreased clearance prolong drug half-lives and lead to increased plasma drug concentrations in older people.<sup>2</sup></li></ul>
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**How are older adults different?  
Why are medications an issue? (continued)**

<ul style="list-style-type: none"><li>• Hepatic function also declines with advancing age, and age-related changes in hepatic function may account for significant variability in drug metabolism among older adults.</li></ul>	<ul style="list-style-type: none"><li>• Total body water decreases which affects water soluble drugs (decreases levels).<sup>2</sup></li></ul>
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**Four Pharmacokinetic Phases of Drug Activity**

- Absorption – The process of getting a drug into circulation
- Depending upon the drug and route of administration, absorption occurs in...
  - Gastrointestinal tract
  - Mucous membranes
  - Muscle
  - Skin
  - Subcutaneous tissue
- Once absorbed, the drug is sent circulation.

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**Four Pharmacokinetic Phases of Drug Activity (continued)**

- From circulation, the drug is distributed to the sites of action and storage.
- Distribution is the dissemination of substances throughout the tissues and fluids in the body.
- Distribution
  - Sites of action
    - Tissues and organs
  - Sites of storage
    - Bone and fat

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**Four Pharmacokinetic Phases of Drug Activity (continued)**

- Metabolism or biotransformation is the process by which a drug is converted from the parent molecule into inactive and active metabolites.
- Metabolism or biotransformation (occurs within)
  - Circulation
  - Tissues
  - Organs of action
  - Liver

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**Four Pharmacokinetic Phases of Drug Activity (continued)**

- Elimination or excretion is the process by which the drug and its metabolites are cleared from the body.
- Elimination (from body)
  - Tissue
  - Organ
  - Liver
  - Kidney

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### Factors Affecting Absorption in the Older Adult

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| <ul style="list-style-type: none"> <li>• Absorption           <ul style="list-style-type: none"> <li>▪ Increased gastric pH (less acidic than middle-aged adult)</li> <li>▪ Decreased GI motility in the older adult</li> <li>▪ Decreased blood flow in the GI tract</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• In general, absorption of medications in the elderly is not significantly different from the younger adult except when...           <ul style="list-style-type: none"> <li>▪ Older adult is taking medications which affect gastric pH (PPI)               <ul style="list-style-type: none"> <li>• Higher pH means less drug is broken down rendering more available to be absorbed.</li> </ul> </li> <li>▪ Adult is taking drugs which alter motility or has a gastric emptying issue</li> </ul> </li> </ul> |
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### Examples of Medication Issues Related to Absorption<sup>2</sup>

- Proton pump inhibitors
  - Decreased absorption of vitamin B<sub>12</sub>, iron, calcium, and magnesium
  - Increased risk of B<sub>12</sub> deficiency, iron, and magnesium deficiencies
  - Increased risk of osteoporosis and fractures
  - Increased risk of CAP and *C. difficile*
  - May increase risk of acute and chronic kidney disease

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### Medications which Impact Absorption<sup>3</sup>

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| <ul style="list-style-type: none"> <li>• GLP-1 receptor agonists           <ul style="list-style-type: none"> <li>▪ Exenatide</li> <li>▪ Liraglutide</li> <li>▪ Semaglutide</li> <li>▪ Lixisenatide</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• Mechanism of action – Delay gastric emptying           <ul style="list-style-type: none"> <li>▪ GLP-1RAs may produce clinically significant interactions with drugs that require achievement of target peak concentrations or a rapid onset of action.</li> <li>▪ For instance, the area under curves (AUCs) of acetaminophen and lovastatin were decreased after exenatide administration and those of lisinopril and digoxin were decreased after liraglutide administration.</li> </ul> </li> </ul> |
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### Factors which Affect Distribution in Elderly<sup>2</sup>

- Total body water is decreased by approximately 20%.
  - Levels of water-soluble drugs may go down.
- Increase in body fat by approximately 35%
  - Levels of drugs which are fat soluble may go up.
- In general, decreased serum albumin
  - Systemic levels of drugs which are highly protein bound may be higher.

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### Water Soluble Medications<sup>4</sup>

- Aminobenzoate potassium (Potaba<sup>®</sup>, Para-aminobenzoic acid [PABA])
- Ascorbic acid (ASCOR<sup>®</sup>, Cenolate<sup>®</sup>, vitamin C)
- Cyanocobalamin (Vitamin B<sub>12</sub>, Nascobal<sup>®</sup>, CaloMist<sup>®</sup> nasal spray, Athlete, cobalamin, Cobex, Crystamine, Prime, Rubramin PC, Vibisone, eligen B<sub>12</sub>)
- Folic acid (Folvite<sup>®</sup>)
- Magnesium supplement (Mag-Tab<sup>®</sup> SR)
- Niacin (Vitamin B<sub>3</sub>, Niacor<sup>®</sup>, Niaspan<sup>®</sup>, nicotinic acid)
- Pyridoxine (Vitamin B<sub>6</sub>, Nestrex)
- Thiamine (Vitamin B<sub>1</sub>)
- Vitamin B<sub>2</sub> (Riboflavin)

**Levels may be decreased.**

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### Fat Soluble Medications

**Levels may be higher.**

Drug Name	Indication	Solubility in Water	Bioavailability
Azelenazole	Allergic Rhinitis	Insoluble	Low - moderate
Cyclosporin	Peripheral vascular disease	Insoluble	Low
Perphenazine	Psychotic disorder	Insoluble	Low
Testosterone	Androgen Replacement Therapy	Insoluble	Low
Famotidine	GERD	Slightly soluble	Low (20-50%)
Budesonide	Allergic Rhinitis	Sparingly soluble	Low (<15%)
Meclozamine	irritable Bowel Syndrome	Slightly soluble	Low (<20%)
Clemastine fumarate	Allergic Rhinitis	Slightly soluble	Low (<30%)
Buprenorphine	Pain	Slightly soluble	Low (<30%)
Sildenafil	Anxiety	Slightly soluble	Low (14%)
Auranofin	Arthritis	Slightly soluble	Low (15-25%)
Felodipine	Hypertension	Insoluble	Low (15%)
Teradipine	Hypertension	Insoluble	Low (15-24%)
Dancitol	Endometriosis	Insoluble	Low
Loratadine	Allergic Rhinitis	Insoluble	Low
Isosorbide dinitrate	Angina	Sparingly soluble	Low (20-30%)
Fluphenazine	Psychotic disorder	Insoluble	Low (2-7%)
Spiroolactone	Hypertension, Edema	Insoluble	Low (25%)
Biperiden	Parkinson's disease	Sparingly soluble	Low (29-33%)
Cyclosporin	Transplantation	Slightly soluble	Low (30%)
Netilmicin	Bacterial Infection	Slightly soluble	Low (30-40%)
Cisapride	GERD	Insoluble	Low (35-40%)
Nabumetone	Arthritis	Insoluble	Low (35%)
Dronabinol	Antiemetic	Insoluble	Low 10-20%
Loxastatin	Hyperlipidemia	Insoluble	Low (<5%)
Simvastatin	Hyperlipidemia	Insoluble	Low (<5%)

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### Examples of Highly Protein-bound Drugs

Lower binding of these medications leads to higher systemic levels.  
(Increased risk of adverse events)

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| <ul style="list-style-type: none"> <li>• Amitriptyline</li> <li>• Digoxin</li> <li>• Furosemide</li> <li>• Hydralazine</li> <li>• Nortriptyline</li> </ul> | <ul style="list-style-type: none"> <li>• Phenytoin</li> <li>• Propranolol</li> <li>• Spironolactone</li> <li>• Warfarin</li> </ul> |
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### Additional Important Medications Affected by Distribution<sup>5</sup>

- Diazepam – Volume of distribution is increased.
  - Increased CNS depression
  - Increase in respiratory depression
  - Doses used in a younger person are going to increase risk of sedation, falls, and respiratory depression.

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### Beers Criteria<sup>5</sup>

- Benzodiazepines
  - Short- and intermediate-acting
    - Alprazolam, lorazepam, oxazepam, temazepam, triazolam
  - Long-acting
    - Clorazepate, chlordiazepoxide, chlordiazepoxide-amitriptyline, acidinium-chlordiazepoxide, clonazepam, diazepam, flurazepam, and quazepam
  - Older adults have increased sensitivity to benzodiazepines and slower metabolism of long-acting agents.
  - In general, all benzodiazepines increase risk of cognitive impairment, delirium, falls, fractures, and motor vehicle accidents in older adults.

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**Factors which Affect Metabolism in the Elderly<sup>6</sup>**

- Drugs which are metabolized by the liver may be affected by...
  - Decreased blood flow to the liver
  - Decreased liver volume or mass; at least 50%
    - Greatest decline in liver mass is between 60–70 years of age.
- Even if liver function continues and is normal, the function of the CYP450 hepatic enzymes declines.

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**Cytochrome P450**

- History of CYP450
  - Not much was known about this drug metabolism system until terfenadine, and erythromycin began producing Torsade de Pointe.
- CYP450
  - Enzymes, found within the liver, which metabolize various medications
- Many medications utilize these pathways for metabolism.

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**CYP450 (continued)**

<ul style="list-style-type: none"> <li>• Purpose of this enzyme system is to metabolize a substance so that it may be broken down and excreted or so that it may be delivered to the tissues on which it will act.</li> </ul>	<ul style="list-style-type: none"> <li>• The cytochrome (CYP450) isoenzymes are a group of heme-containing enzymes embedded primarily in the lipid bilayer of the endoplasmic reticulum of hepatocytes.</li> </ul>
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**Pathways**

There are a number of enzymes or pathways.

1A2

2C9

2C19

3A4

2D6

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**Weighted Importance of CYP450**

**Relative Importance of CYP450 in Drug Metabolism**

Isoenzyme	Relative Importance (Estimated)
CYP3A	45%
CYP2D6	25%
CYP2C	15%
CYP1A2	10%
CYP2E1	5%

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**Terminology**

- **Substrates**
  - Metabolized by the isoenzyme

- **Inhibitors**
  - Block the activity of the isoenzyme
  - Inhibition most often occurs as a result of competitive binding at the enzyme's binding site

- **Inducers**
  - Accelerate the activity of the isoenzyme

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**Inhibitors?**

Inhibitors are ranked.

- Strong inhibitors
  - >5-fold increase in the plasma AUC values or more than 80% decrease in clearance
- Moderate inhibitors
  - >2-fold increase in the plasma AUC values or 50–80% decrease in clearance
- Weak inhibitors
  - >1.25-fold but <2-fold increase in the plasma AUC values or 20–50% decrease in clearance

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**Olanzapine**

- Olanzapine
  - Liver metabolized
  - CYP 1A2 substrate
- Nicotine
  - 1A2 inducer
  - Clears olanzapine more readily; 98% increased clearance in smokers

What happens when smoker quits?

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**Sample of Important Interactions in the Elderly**

Drug(s) A	Drug(s) B	Potential Risks
Atenolol	Clonidine, Diltiazem	Bradycardia, hypotension, AV conduction disorder
Captopril, Enalapril	Spirolactone	Hyperkalemia
Clonidine	Propranolol, Verapamil	Bradycardia
Fluoxetine	Fluconazole	Cardiotoxicity

For more information: Potential Drug-Drug Interactions in Prescriptions to Patients over 45 Years of Age in Primary Care, Southern Brazil (2012, Oct.) PLoS ONE, Research Gate.  
[https://www.researchgate.net/figure/Frequency-of-pairs-of-major-potential-drug-drug-interactions-in-prescriptions-dispensed\\_fig4\\_232257343](https://www.researchgate.net/figure/Frequency-of-pairs-of-major-potential-drug-drug-interactions-in-prescriptions-dispensed_fig4_232257343) CC BY 4.0

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**Factors which Affect Elimination in the Elderly<sup>6</sup>**

- Elimination is impacted by kidney function.
- As we age, renal function declines by at least 50% when compared with a younger adult.
- While kidney function may appear normal, there is still an age-related decline.

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**Creatinine Clearance<sup>6</sup>**

- Creatinine – Inaccurate number
- Creatinine clearance – Much more accurate
  - To adjust dosage to compensate for decreased kidney function, creatinine clearance is one of the most reliable formulas.
  - Ideal creatinine clearance is 100–120 mL/min.
  - Download for healthcare professionals – Free online medical reference (MDcalc [app]); also available in mobile health app (Epocrates®)
- GFR – Also, a very accurate number
  - Many medications have moved to GFR and away from creatinine clearance.
    - i.e., Metformin

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**Metformin Updates<sup>8</sup>**

- Metformin is contraindicated in patients with an eGFR below 30 mL/min/1.73 m<sup>2</sup>.
- Starting metformin in patients with an eGFR between 30 to 45 mL/min/1.73 m<sup>2</sup> is not recommended.
- In patients taking metformin whose eGFR later falls below 45 mL/min/1.73 m<sup>2</sup>, assess the benefits and risks of continuing treatment.
- Discontinue metformin at the time of or before an iodinated contrast imaging procedure in patients with an eGFR between 30–60 mL/min/1.73 m<sup>2</sup>; in patients with a history of liver disease, alcoholism, or heart failure; or in patients who will be administered intra-arterial iodinated contrast.
- GFR: 30–35 mL/min/1.73 m<sup>2</sup> – Maximum dosage 1000 mg daily

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**Important Medications Affected By Clearance**

- Lithium
  - Exclusively renally cleared
  - Increased serum concentrations
  - Narrow therapeutic index

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**Patient Scenario**

- 72-year-old female with bipolar disorder
- Treated with lithium 300 mg once daily (managed by psych NP)
  - Has been on for years
  - Lithium level – 1.0 (last evaluated approximately 1-month ago)
- Diagnosed with hypertension by primary care provider and treated with hydrochlorothiazide

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**Patient Scenario (continued)**

- 1-month later
  - Tremulous, nauseated, confused
  - Lithium level – 2.6
- What happened?
- Can this occur with other medications?

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**Other Important Concepts of Elimination**

- Half-life
  - Time it takes for a drug to decline by 50% in the serum
  - In general, take ½ life of a drug and multiply by 5. This is the amount of time it takes a drug to reach its steady state.
- Steady state
  - Time it takes for the amount of medication in blood stream to be consistent at all times

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**Elimination of Sulfonylureas**

- Renally eliminated but some are liver metabolized
- Individuals with CKD have decreased clearance, increasing the risk for hypoglycemia.
- Glimepiride, glipizide, glyburide
  - Glimepiride: 9-hour half-life, 60% excreted in urine, 40% feces
  - Glipizide: 2–5 hour half-life, 80% excreted in urine, 10% feces
    - Liver extensively (2C9 substrate)
  - Glyburide: 10-hour half-life, 50% excreted in urine, 50% bile

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**Additional Medications Affected by Decreased Renal Elimination**

- Many antibiotics (ciprofloxacin, cephalosporins)
- Allopurinol
- Atenolol
- Colchicine
- Digoxin
- Gabapentin and pregabalin
- HCTZ
- Theophylline

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**Other Factors which Affect Pharmacokinetics**

<ul style="list-style-type: none"> <li>• Gender           <ul style="list-style-type: none"> <li>▪ Men and women respond differently to medications.</li> <li>▪ Men, in general, tend to metabolize medications more rapidly than women. (2x higher level in women than men)</li> <li>• Example – Amlodipine works much more effectively in women than men.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Ethnicity           <ul style="list-style-type: none"> <li>▪ Likely is a big determinant of drug effects</li> <li>▪ For instance, beta blockers work much better in patients of European ancestry than African ancestry; greatest effect in those of Chinese ancestry</li> <li>• Why – Asian population tends to have lower activity of CYP2D6 enzymes</li> </ul> </li> </ul>
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**Example of Commonly Prescribed Medication**

<ul style="list-style-type: none"> <li>• Rosuvastatin           <ul style="list-style-type: none"> <li>▪ 2C9 substrate</li> <li>▪ 5 mg is starting dose in patients of Asian ancestry.</li> <li>▪ 10 mg is maximum dosage.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Liver metabolized, renally excreted</li> </ul>	<ul style="list-style-type: none"> <li>• 10 mg is also maximum dosage in individuals with CrCL &lt; 30 mL/min.</li> <li>▪ What do the guidelines say about individuals with ASCVD or LDL ≥ 190 mg/dL (4.92 mmol/L)?</li> </ul>
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**Pharmacogenomic/Pharmacogenetic Testing<sup>9</sup>**

- What is it?
  - Study of how a person's genes affect their metabolism of medications
- Numerous companies provide this service
- Covered by CMS (co-insurance) for most patients
- Can be really helpful in choosing medications or fine-tuning therapy

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Beers Criteria	
<ul style="list-style-type: none"> <li>• First developed in 1991; most recent revision was 2019.</li> <li>• Now includes more than 50 medications</li> </ul>	<ul style="list-style-type: none"> <li>• Three categories               <ul style="list-style-type: none"> <li>▪ Medications to avoid</li> <li>▪ Potentially inappropriate in those with certain conditions or syndromes</li> <li>▪ Those to use with caution</li> </ul> </li> </ul>

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Important Medication Classes to Avoid Per Beers Criteria in Older Adults	
<ul style="list-style-type: none"> <li>• Anticholinergic medications               <ul style="list-style-type: none"> <li>▪ 1<sup>st</sup> generation antihistamines, antipsychotics, overactive bladder medications, tricyclic antidepressants, hyoscyamine, paroxetine</li> <li>▪ Increased risk of cognitive decline and dementia (risk declines with medication discontinuation)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Anti-Parkinson agents               <ul style="list-style-type: none"> <li>▪ Benztropine (oral) and trihexyphenidyl</li> </ul> </li> <li>• CNS depressants               <ul style="list-style-type: none"> <li>▪ Increased effects</li> </ul> </li> </ul>

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Important Medication Classes to Avoid Per Beers Criteria in Older Adults (continued)
<ul style="list-style-type: none"> <li>• Tertiary TCAs, alone or in combination               <ul style="list-style-type: none"> <li>▪ Amitriptyline</li> <li>▪ Chlordiazepoxide-amitriptyline</li> <li>▪ Clomipramine</li> <li>▪ Doxepin &gt;6 mg/d</li> <li>▪ Imipramine, perphenazine-amitriptyline</li> </ul> </li> </ul>

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### Atypical Antipsychotics

- Increased risk of falls
- Increased risk of death when used in older adults with dementia
  - 1.6–1.7 x increased risk compared with placebo-treated patients
  - Infectious or cardiovascular in nature

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### Emergency Room Visits

- 33% of all emergency department visits in the older adult
  - Insulin
  - Warfarin
  - Digoxin
- 67% of all emergency department visits in the older adult
  - Warfarin
  - Insulin
  - Oral antiplatelet agents
  - Oral hypoglycemics

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### Warfarin (Coumadin®)

- First identified in the 1940s
- Became prominent in 1955 when Dwight D. Eisenhower was given warfarin after he suffered an MI.
- At present, 2 million individuals are taking warfarin (Coumadin®).
- Yet only 1/3–1/2 of eligible patients are currently prescribed this drug.

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### Actions of Warfarin

- Inhibits the synthesis of vitamin K-dependent clotting factors which include – Factors II, VII, IX, and X; and the anticoagulant proteins C and S
- Completely absorbed after oral administration
  - Peak concentration is attained within the first 4 hours.
  - 98% of warfarin is bound to plasma proteins.
    - Therefore, need to be aware that any highly protein bound drug added on to the individual taking warfarin may end up displacing warfarin (increasing warfarin levels and thus raising INR).

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### GP

- GP failed to convert to NSR despite elective cardioversion.
- Opted to maintain her on warfarin
- 6 months into therapy
  - INR which was previously controlled at 2.5–3.0
  - Average – 2.8
- Now – INR 4.3
- **What has changed?**

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### Review of Diet and Medications

- GP decided to start herself on garlic and ginkgo for cardiovascular disease prophylaxis.
- Also wanted to improve her memory
- Numerous herbs can affect warfarin and the INR.

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**Drug Interactions**

- Drug interactions involving warfarin are characterized as either pharmacokinetic or pharmacodynamic in nature.
  - Pharmacokinetic interactions cause changes in systemic concentrations of warfarin by interfering with 1 or more of the following...
    - Absorption, protein binding, metabolism

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**Various Medications Impact the INR**

<ul style="list-style-type: none"><li>• Increases anticoagulant effect<ul style="list-style-type: none"><li>▪ Acetaminophen</li><li>▪ Beta-blockers</li><li>▪ Ketoconazole</li><li>▪ Thyroid hormones</li><li>▪ Lovastatin</li><li>▪ Metronidazole</li></ul></li></ul>	<ul style="list-style-type: none"><li>• Decreases anticoagulant effect<ul style="list-style-type: none"><li>▪ Dicloxacillin</li><li>▪ Trazodone</li><li>▪ Estrogens</li><li>▪ Thiazide diuretics</li></ul></li></ul>
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**Herbal and Dietary Supplements**

- ¼ of U.S adults reported that they do not inform their healthcare provider about dietary or herbal supplements.
- Recent survey showed that 10–22% of older adults are taking supplements which interact or have the potential to interact with current prescription medications.

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### Herbal and Dietary Supplements

- Most information about these products are found on the internet by the older adult.
- Most common herbal supplements used by the older adult
  - Ginkgo, St. John's wort, echinacea, ginseng, garlic, saw palmetto, kava, and valerian root

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### Sample Herb-Drug Interactions

Herbal Agents	Interacting Drugs	Clinical Effect
Danshen, Dong quai, Ginkgo biloba	Warfarin	Bleeding
Garlic, Ginseng,	Warfarin	Lowers blood level
St John's wort	Antidepressants, Cyclosporine, Digoxin	Serotonergic stimulation, decreased cyclosporine effect, decreased serum digoxin level
Ginkgo biloba	Trazodone, morphine	Coma, lack of morphine effect
Kava	Benzodiazepines	CNS depression
Valerian	Anxiolytics	CNS sedation

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### Malpractice Case

- 68-year-old male with diabetes and atrial fibrillation presents to a specialty NP for management of diabetes and high triglycerides.
- A1C – 8.2% (0.082 proportion), triglycerides – 1104 mg/dL (12.5 mmol/L)
- Medications – Basal insulin, rapid acting insulin, atorvastatin, warfarin
  - Warfarin – Multiple mechanisms of metabolism (CYP1A2 substrate, CYP2C8 substrate, CYP2C9 substrate, CYP3A4 substrate)

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## Slide 59

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**RKO** Wendy to get permission to use, please see:  
<https://www.ebmedicine.net/contact.php>  
Renee Kirshner, 2022-09-12T23:26:53.642

**RK1** Molly, if Wendy is able to get permission, I will add this in the back as part of the image source figures. Thanks  
Renee Kirshner, 2022-09-12T23:29:02.095

**MS1 0** I re-did this slide for the drug-drug interactions---Wendy will need to decide which program you want to keep these in  
Margaret Salinas, 2022-09-15T20:38:16.740

**Malpractice Case (continued)**

- INRs managed by primary care provider. Generally obtained monthly.
  - Last INR – 3 days ago and 2.1
- Fenofibrate added to regimen 48 mg once daily; told to follow-up with primary care provider for INR
  - Weak CYP2C9 inhibitor

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**2 weeks later...**

- Presents to emergency department
- Severe headache, confusion, abnormal neurological examination
- INR – 9.2
- CT – Confirms large subdural bleed, multiple locations
- Patient died over the next 72 hours.
- **What happened and what could have been done differently?**

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**Polypharmacy in the Elderly**

- Society is conditioned to believe that a pill fixes everything.
- Many clinicians are conditioned to believe that a pill is always needed.
- Finding the balance is always the key.
- Consequences
  - Adverse events
  - Drug-drug interactions
  - Cost
  - Decreased quality of life

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**Adverse Drug Events (AEs)**

- More than 2 million every year
- More than 100,000 deaths annually
- More than 95% are predictable and 50% preventable
- **These increase significantly when an individual is on 5 or more medications.**

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**Risks for AEs in the Older Adult<sup>6</sup>**

- Low body weight
- Age  $\geq 85$  years
- $>12$  or more medication doses per day
- 6 or more medications
- GFR  $<60$  mL/min/1.73 m<sup>2</sup>

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**Additional Considerations**

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### Macrolides

- Known QT prolongation
- Caution with other drugs which have similar potential...
  - Tricyclic antidepressants
  - Fluoroquinolones
  - Antipsychotics
  - Antiarrhythmics

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### Underprescribing – Is it an issue?

- While much of the literature focuses on overprescribing or polypharmacy in the older adult, underprescribing is equally problematic.
- Chronic conditions are undertreated.
- For instance, only 19% of older adult with CAD are prescribed a statin.

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### Common Time for Medication Confusion

- Discharge from hospital or long-term care facility
- Inappropriate medications or duplication of medications are common.
- 23% of older adults experience an adverse drug event after discontinued from hospital; ½ are preventable
- Transition of care visit is essential.

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**Transition of Care Visit**

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- 72-year-old male
  - Hypertension, gout, atrial fibrillation, hyperlipidemia, sleep apnea (treated with CPAP)
  - Allergies – Amlodipine (ankle edema), HCTZ (gout)
  - Medications
    - Allopurinol 300 mg daily, lisinopril 20 mg BID, flecainide daily, pravastatin

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**Transition of Care Visit (continued)**

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- 72-year-old male (cont.)
  - Admitted to hospital for angioedema and stridor after 15+ years on an ACE inhibitor
  - Cardiology started patient on clonidine 0.1 mg TID.
  - BP – 136/82 mm Hg at TIC visit; tolerating well and feeling well

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**3 Months Later**

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- Patient's wife comes in for a visit with patient.
- He is restless and combative during night.
  - Having terrible dreams, punched her in the head.
  - She is scared for her safety during night and has begun to sleep in a different room.
- **What is going on?**

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**Clonidine**

- Other common adverse effects may include...
  - Drowsiness, dizziness
  - Feeling tired or irritable
  - Cold symptoms, such as runny/stuffy nose, sneezing, cough, sore throat
  - Mood changes
  - Sleep problems (insomnia), nightmares
  - Headache, ear pain
  - Mild fever
  - Feeling hot

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**Important Strategies for Prescribing in the Older Adult**

- Print medication list for patient (brand and generic names).
- Ask patient to bring in medications with every visit (including supplements).
- Reconcile medications at every visit.
- Use a few drugs well rather than a lot of drugs poorly.
- Start low and go slow.
- Avoid multiple dosages each day.
- Follow up when starting a new medications.
- Avoid medication cascade.

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**I would be happy to entertain any questions you have!**

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**End of Presentation!**  
**Thank you for your time, attention.**

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 DNP, ANP-BC, FNP-BC, FAANP, FAAN, FNAP

WendyARNP@aol.com

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