



MEDICATION MANAGEMENT IN THE OLDER ED PATIENT

UofA Emergency Medicine Residents

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OBJECTIVES

1. Describe the pharmacokinetic and pharmacodynamic changes associated with aging.
2. Demonstrate how to complete a detailed medication review, and consider adverse reactions and drug-drug interactions.
3. Prescribe appropriate drugs and dosages that account for the patients age-related physiologic changes, diagnoses, other medications, and functional status.
4. Recognize high risk medications and how they can be safely used or avoided.
5. Demonstrate strategies for effective communication about medications to older patients.



- Older people average 6.9 different drug classes per year
- 25% of older people are prescribed 10+ drug classes each year



WHY IS OLDER AGE RELATED TO INCREASED
ADVERSE DRUG REACTIONS (ADR)?



WHY IS OLDER AGE RELATED TO INCREASED ADVERSE DRUG REACTIONS (ADR)?

Age-related changes in pharmacokinetics and pharmacodynamics

Correlation between frailty, ADRs and inappropriate prescriptions

Multimorbidity (drug-disease interaction)

Geriatric syndromes (falls, orthostatic hypotension, chronic pain, incontinence, delirium etc.)

Cognitive and sensory impairment – medication errors, non-adherence

Polypharmacy



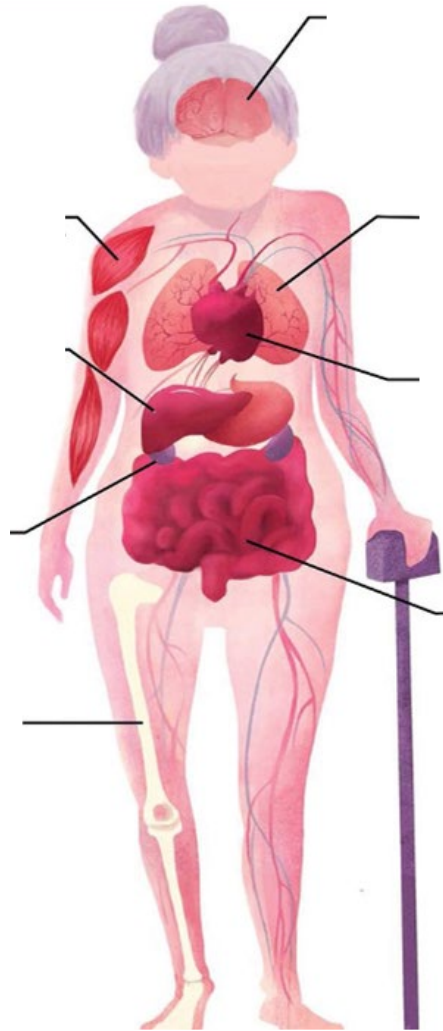
TOP MEDICATIONS FOR ADVERSE DRUG EVENTS IN OLDER PEOPLE?



TOP MEDICATIONS FOR ADVERSE EVENTS IN OLDER PEOPLE

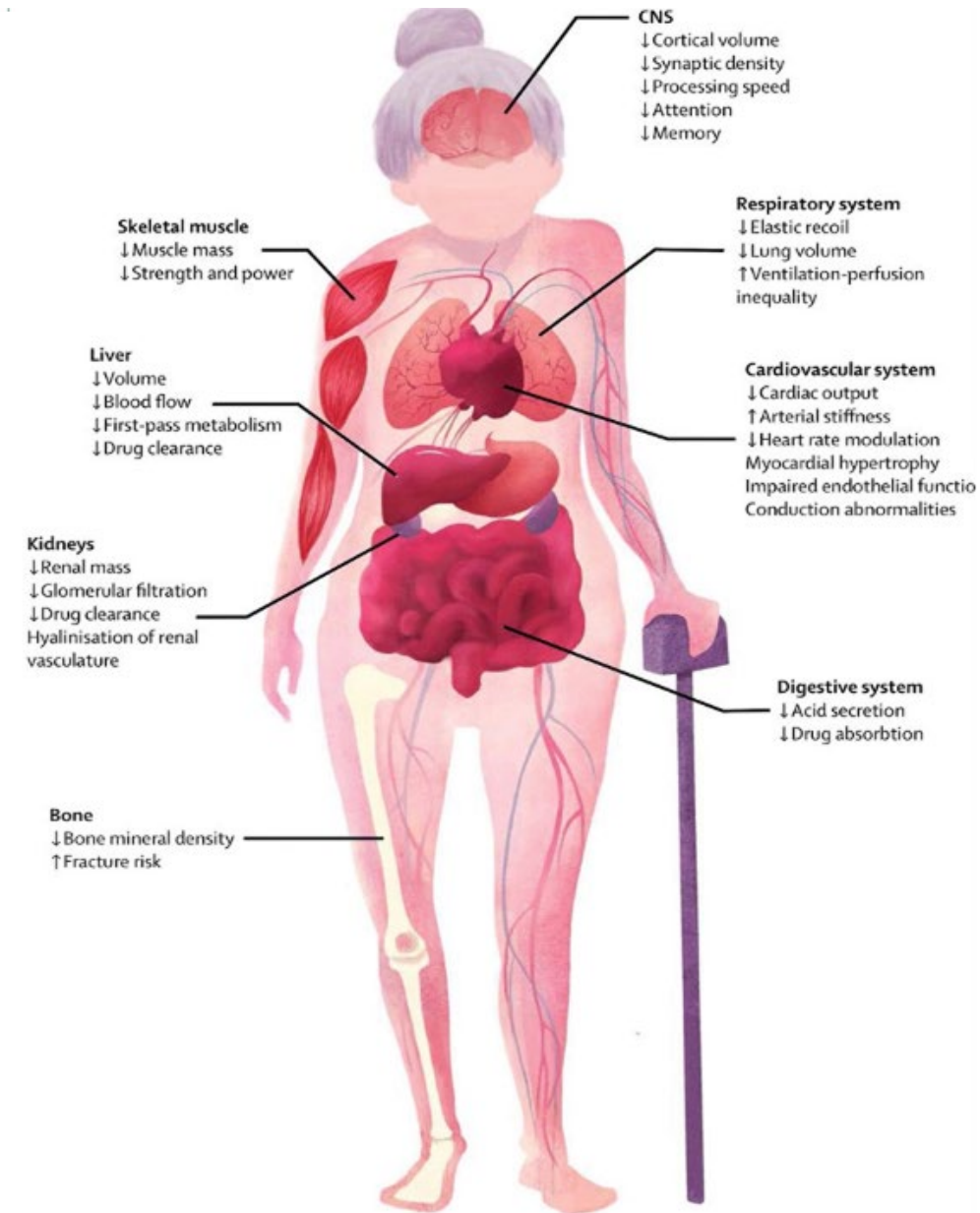
1. Anticoagulants
2. Insulins
3. Antiplatelet agents
4. Oral hypoglycemic agents
5. Opioids
6. Antibiotics
7. Diuretics
8. NSAIDs
9. Sedatives / antipsychotics

PHYSIOLOGY OF AGING



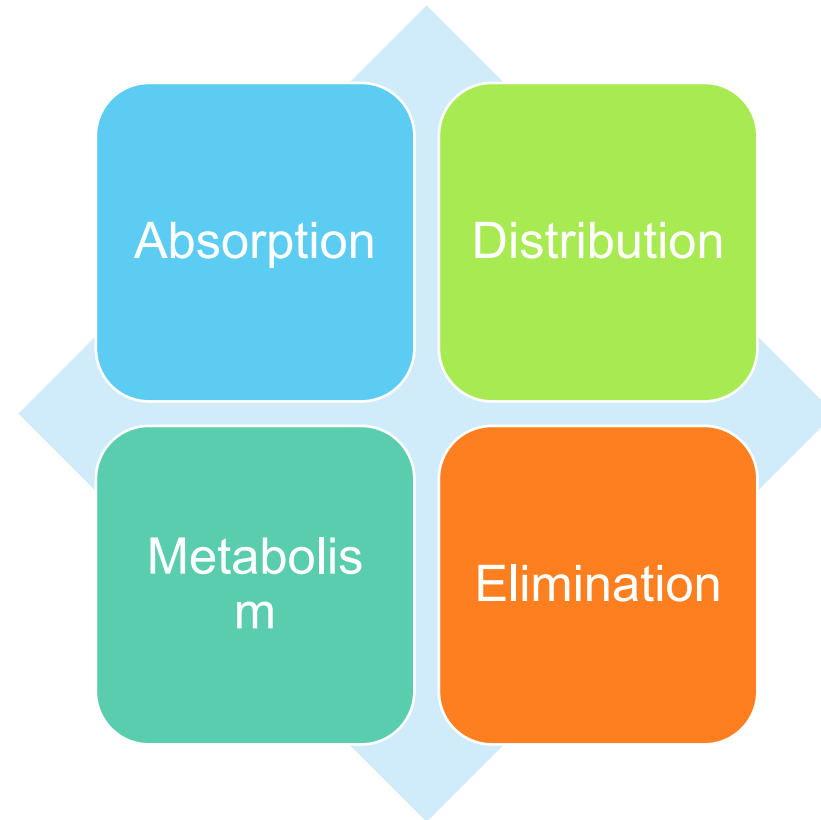


PHYSIOLOGY OF AGING



- **Brain:**
 - ↓ brain mass
 - ↓ nerve cells in brain
 - ↓ NTs
 - ↓ cerebral blood flow
 - ↓ response to adrenergic stimulation
 - ↑ blood brain barrier permeability
- **Heart:**
 - ↓ CO
 - ↑ resting HR
 - ↓ elasticity
 - ↑ LV thickness
 - ↑ LA size
- **Renal:**
 - ↓ renal cortical mass
 - ↓ renal blood flow
 - ↑ susceptibility to nephrotoxicity
- **Liver:**
 - ↓ hepatocytes / size
 - ↓ blood flow
 - ↓ enzyme system activity

PHARMACOKINETICS & AGING



What the body does to the drug

ABSORPTION

Changes with aging	Clinical impacts in the ED
↑ gastric pH	These changes are not clinically significant
↓ gastric ADH activity (greater ↓ in women)	
↓ gastric and intestinal motility	



DISTRIBUTION

Changes with aging	Clinical impacts in the ED
— proportion of fat	Lipophilic drugs (e.g. haloperidol, sedative hypnotics) will have:
— proportion of water	Hydrophilic drugs (e.g. lithium, digoxin) will have:
— protein binding capacity	Drugs with high protein binding capacity (VPA, phenytoin) will have:
↓ P-glycoprotein ability at blood brain barrier	



DISTRIBUTION

Changes with aging	Clinical impacts in the ED
↑ proportion of fat	Lipophilic drugs (e.g. haloperidol, sedative hypnotics) will have: ↑ Vd ↓ plasma concentrations ↑ terminal half life
↓ proportion of water	Hydrophilic drugs (e.g. lithium, digoxin) will have: ↓ Vd ↑ effective concentration
↓ protein binding capacity	There may be ↑ free plasma levels of medications that have high protein binding capacity. e.g. phenytoin, valproic acid
↓ P-glycoprotein ability at blood brain barrier	↓ ability to prevent certain PGP substrate medications from crossing at BBB, thus more CNS effects will be seen. e.g. digoxin, risperidone, loperamide.

METABOLISM

Changes with aging	Clinical impacts in the ED
↓ liver blood flow by ~30%	Drugs with high first pass extraction rate will have ↑ bioavailability. e.g. labetalol, metoprolol, morphine, amitriptyline, imipramine. ↑ serum concentration of drugs when multiple drugs are metabolized by the same enzymes
↓ liver size by ~30%	
Phase 1 metabolism ↓ by ~30%	
Phase 2 has relatively no change	



ELIMINATION

Changes with aging	Clinical impacts in the ED
↓ in nephrons	Calculate creatinine clearance With poor renal function, renally excreted drugs will have prolonged effects – particularly if the metabolites are active (e.g. nitrofurantoin, morphine, codeine, tramadol)
↓ in cortical blood flow	
GFR ↓ ~10% per decade	
Age related loss of muscle mass	

What clinical factors influence the calculation of creatinine clearance?



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Age related loss of muscle mass	

What clinical factors influence the calculation of creatinine clearance?

1. Age (inc age = ↓CrCl)
2. Body weight (dec weight = ↓CrCl)
3. Sex (females have ↓CrCl)

Creatinine Clearance (Cockcroft-Gault Equation) ☆

Calculates CrCl according to the Cockcroft-Gault equation.

When to Use ▾

Pearls/Pitfalls ▾

Why Use ▾

Sex

Female

Male

Age

30

years

Weight

60

kg ↕

Creatinine

80

μmol/L ↕

Creatinine clearance, original Cockcroft-Gault

Copy Results 📋

Next Steps >>>

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When to Use ▾

Pearls/Pitfalls ▾

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Sex

Female

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Age

80

years

Weight

50

kg ↕

Creatinine

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μmol/L ↕

Creatinine clearance, original Cockcroft-Gault

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When to Use ▾	Pearls/Pitfalls ▾	Why Use ▾
---------------	-------------------	-----------

Sex	☒ Female	☐ Male
Age	30	years
Weight	60	kg ⇄
Creatinine	80	μmol/L ⇄

86 mL/min

Creatinine clearance, original Cockcroft-Gault

Copy Results 📋

Next Steps >>>

Creatinine Clearance (Cockcroft-Gault Equation) ☆

Calculates CrCl according to the Cockcroft-Gault equation.

When to Use ▾	Pearls/Pitfalls ▾	Why Use ▾
---------------	-------------------	-----------

Sex	☒ Female	☐ Male
Age	80	years
Weight	50	kg ⇄
Creatinine	80	μmol/L ⇄

39 mL/min

Creatinine clearance, original Cockcroft-Gault

Copy Results 📋

Next Steps >>>

This WILL affect your medication dosing

PHARMACODYNAMICS & AGING

CNS more sensitive with age

- Sedative hypnotics
- Opioids
- Anticholinergics
- Antipsychotics

CVS impacts with age

- Inc sensitivity to CCB on BP and HR
- Dec response to B-adrenergic receptor agonists + antagonists

What the drug does to the body



Drug-drug interactions



DRUG-DRUG INTERACTIONS

- **Pharmacokinetic drug-drug interactions**
- **Pharmacodynamic drug-drug interactions**
 1. **Eg. Haldol and Ativan**
 2. **E.g. Naproxen and Furosemide**
 3. **E.g. Sulfamethoxazole and Trimethoprim**



DRUG-DRUG INTERACTIONS

- **Pharmacodynamic drug-drug interactions**

1. **Additive:** when the sum of the effect equals the two individual agents
 - e.g. Haldol and Ativan - sedating effects of multiple CNS depressants
2. **Synergistic:** when the combined action of two drugs is greater than would be expected from a purely additive effects
 - e.g. sulfamethoxazole and trimethoprim, combined to increase effectiveness
1. **Antagonistic:** when the drugs have opposite effects on the body and in combination reduce the effectiveness of the other
 - e.g. NSAIDs and diuretics - NSAIDs can increase blood pressure/salt and fluid retention, which antagonizes effects of anti-hypertensives and diuretics.

RESOURCES FOR DRUG- DRUG INTERACTIONS

1. Uptodate
2. Lexicomp
3. Flockhart Cytochrome P450
Drug Interaction Table



COMMON MEDICATION INTERACTIONS

Hypoglycemics + β Blockers

- Impaired glycemic control
- Unrecognized/masked hypoglycemia

ACEi + ARBs and NSAIDS

- Antagonistic interaction: Mild to severe hypertension
- Additive effect on renal insufficiency

Clopidogrel + PPIs

- Increased risk of thrombosis due to CYP2C19 inhibition.

SSRIs/SNRIs + NSAIDs/ASA

- Additive effects: Increased risk of bleeding

Corticosteroids and NSAIDS

- Fluid retention and hypertension
- Increased bleeding risk



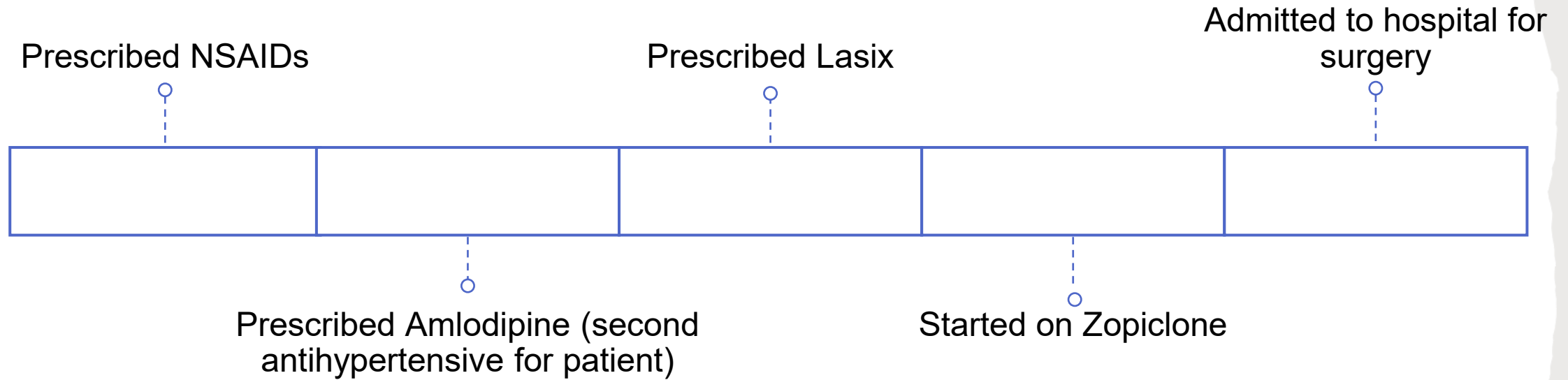
PRESCRIBING CASCADE



PRESCRIBING CASCADE

The misinterpretation of an adverse reaction to one medication, as another medical condition ☐ leads to the prescription of new medications, with their own potential to cause side effects

PRESCRIBING CASCADE



American Geriatrics Society 2023 updated AGS Beers Criteria[®] for potentially inappropriate medication use in older adults



ANTICHOLINERGIC MEDICATIONS





ANTICHOLINERGIC MEDICATIONS

TABLE 1

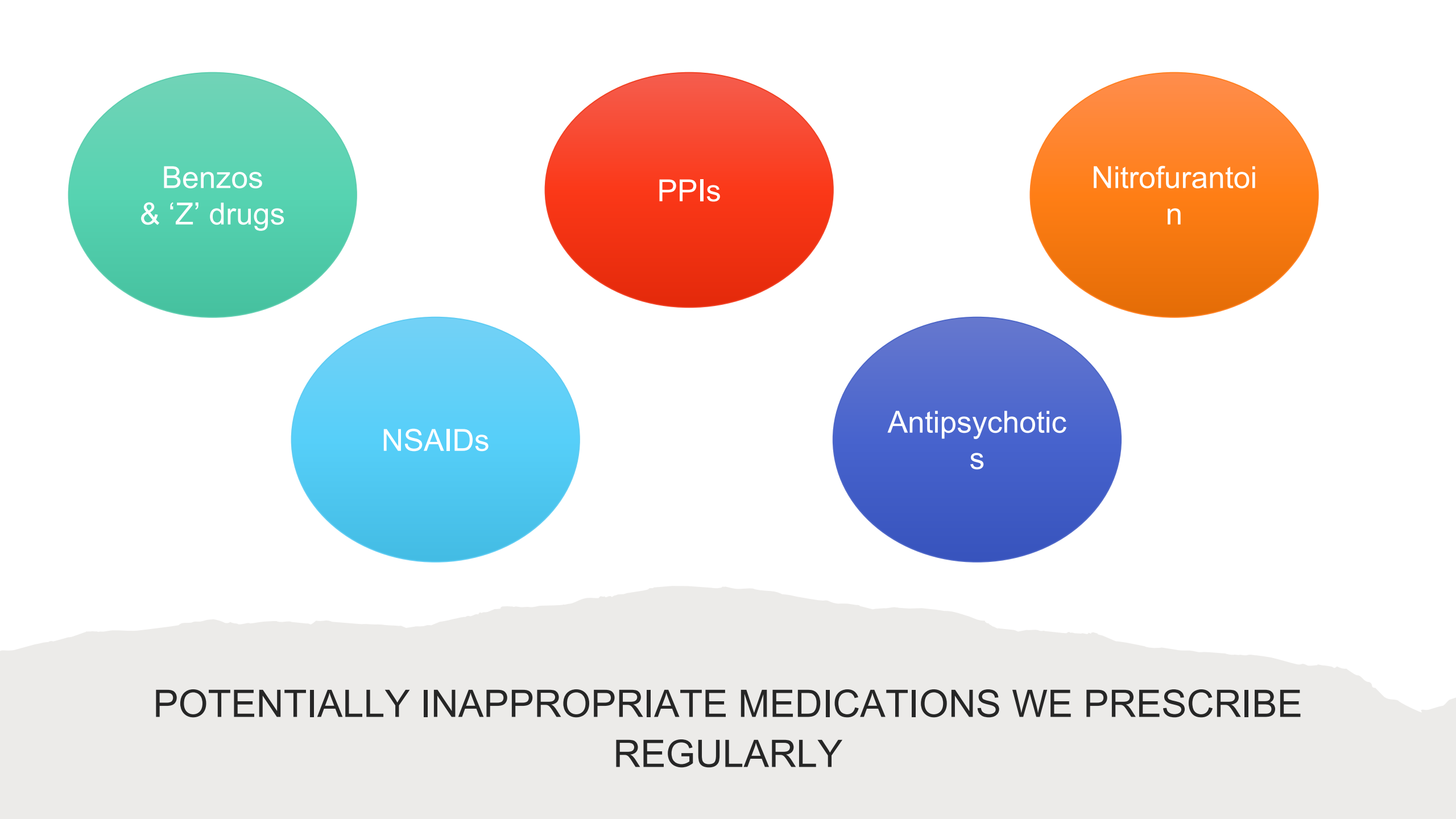
Medications With Strong Anticholinergic Properties

Antidepressants	Antihistamines (first-generation)	Antimuscarinics (urinary incontinence)*	Antipsychotics
Amitriptyline	Brompheniramine	Darifenacin	Chlorpromazine
Amoxapine	Chlorpheniramine	Fesoterodine	Clozapine
Clomipramine	Cyproheptadine	Flavoxate	Olanzapine
Desipramine	Dimenhydrinate	Oxybutynin	Perphenazine
Doxepin (> 6 mg/day)	Diphenhydramine	Solifenacin	Antispasmodics
Imipramine	Doxylamine	Tolterodine	Atropine
Nortriptyline	Hydroxyzine	Trospium	Clidinium-chlordiazepoxide
Paroxetine	Meclizine	Antiparkinsonian agents	Dicyclomine
Antiemetics	Triprolidine	Benztropine	Homatropine
Prochlorperazine		Trihexyphenidyl	Hyoscyamine
Promethazine			Scopolamine
			Skeletal muscle relaxants
			Cyclobenzaprine
			Orphenadrine

Note: This table is not a comprehensive list of all medications with anticholinergic properties.

*—Data on whether certain bladder antimuscarinics confer greater adverse cognitive effects than others lack consistent quality. Oxybutynin has the best evidence for adverse cognitive effects. However, caution is warranted for all bladder antimuscarinics given their potential anticholinergic effects.

Reprinted with permission from American Geriatrics Society 2023 updated AGS Beers criteria for potentially inappropriate medication use in older adults. J Am Geriatr Soc. 2023;71(7):2074.



Benzos
& 'Z' drugs

PPIs

Nitrofurantoin

NSAIDs

Antipsychotics

POTENTIALLY INAPPROPRIATE MEDICATIONS WE PRESCRIBE
REGULARLY



ALTERNATIVE/SAFER OPTIONS

Inappropriate medications	Safer alternative
Dimenhydrinate (for nausea)	
Codeine, tramadol, NSAIDs (for pain)	
Trazodone, zopiclone, benzodiazepines (for sleep aid)	
Diphenhydramine (for allergy)	



ALTERNATIVE/SAFER OPTIONS

Inappropriate medications	Safer alternative
Dimenhydrinate (for nausea)	Ondansetron, metoclopramide, isopropyl alcohol
Codeine, tramadol, NSAIDS (for pain)	
Trazodone, zopiclone, benzodiazepines (for sleep aid)	
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ALTERNATIVE/SAFER OPTIONS

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Diphenhydramine (for allergy)	Cetirizine

PAIN MEDICATION PEARLS

- Standing orders for analgesia and PRN for patients with cognitive impairment and delirium
- Acetaminophen first line for analgesia:
 - max daily dose recommended is unchanged at 4g/day (325-500mg q4h or 500-1000mg q6h).
 - reduce max dose 50-75% in patients with hepatic insufficiency or hx alcohol misuse
- NSAIDS – use with caution:
 - Single dose IV/IM Ketorolac in ED shown to be safe without increased risk of major side effects, but inappropriate for ongoing use.
 - Absolute contraindications (in general): allergy, GFR < 30 or new AKI, active GIB, ACS, acute stroke, CHF exacerbation, and third trimester pregnancy
 - ED Rx for SHORT-TERM use in absence of contraindications: consider a 50% dose reduction (ibuprofen 200mg q8h; naproxen 250mg q12h), with concomitant use of a PPI for those high risk for GI bleeds

PAIN MEDICATION PEARLS: OPIOIDS

Avoid combination opioid medications

Hydromorphone preferred to morphine:

- Predisposition for reduced Cr clearance in older persons. Morphine metabolites accumulate at higher concentrations compared to hydromorphone
- Lacking clear guidance on dosing, but recommend 30-50% dose reductions compared to younger pts
 - Hydromorphone 0.25-0.5mg IV (titrate to effect)
 - Hydromorphone 0.5-1mg PO q4h (for discharge prescriptions; *base on tolerance in ED)

Tramadol NOT recommended

- CNS side effects, risk SIADH, risk of serotonin syndrome in patients on SSRIs

PROCEDURAL SEDATION CONSIDERATIONS

In general, older persons are higher risk with procedural sedation

Propofol

- Increased sensitivity due to inc BBB permeability
- Limited physiologic reserve (cardioresp function)
- Highly lipophilic and renally cleared □ prolonged clearance and higher plasma concentrations in older patients
- Initial bolus of ≤ 0.5 mg/kg (vs 0.5-1.0 mg/kg) + additional boluses 0.25-0.5 mg/kg q 1-3 min

Ketamine

- Less evidence in older patients
- Overall effect is a higher active plasma concentration & prolonged clearance
- Lower initial dose: 0.2-0.75mg/kg (0.3mg/kg reasonable starting dose)
- Not recommended in patients with severe HTN or CAD

DEPRESCRIBING

- The ED is not the safest point of care to make major changes
- Identify concerning medications, bring this to the attention of the patient/caregiver.
- Encourage f/u with GP to review their medications
 - Send a letter/fax the chart to the GP to prompt discussion
- Consider de-prescribing NSAIDs
- Consider benzo tapering. Provide the EMPOWER trial pdf.



STOPP CRITERIA

- Screening Tool of Older People's Potentially Inappropriate Prescriptions

TABLE 185.4

Top 10 STOPP Criteria

RANK	CRITERIA
1	Long-term use of benzodiazepines
2	Duplicate prescriptions from the same drug class
3	Proton pump inhibitor for peptic ulcer disease at full dose for >8 wk
4	NSAIDs in patients with moderate to severe hypertension
5	Long-term use of opioids—first-line treatment for mild to moderate pain
6	Aspirin without adequate cardiovascular risk
7	Warfarin and NSAID used together
8	Beta blocker in patients with chronic obstructive pulmonary disease
9	Prolonged use of first-generation antihistamines
10	NSAID use in patients with chronic renal failure

NSAID, Nonsteroidal antiinflammatory drug; STOPP (Screening Tool of Older People's Potentially Inappropriate Prescriptions).

OTHER PRESCRIBING TIPS

Home medications in the ED

- Ensure you are ordering important, time sensitive medications.
- Parkinson medications should ALWAYS be ordered in the ED

Consider time of day for medications you prescribe

- Steroids, bowel care, diuretics, etc.

Discharge instructions

- Written instructions on medication changes, new additions
- Letter to GP when making changes or suggesting changes
- Follow-up plan

Administration

- Home care needed for med assist?
- Blister packs?

SUMMARY



Review medications and interactions



Ensure clear indication



Start low, go slow



Counsel regarding side effects



Ensure follow-up plans

RESOURCES

1. **Meds Review** – medication review that can be completed by any community pharmacist for free annually, for patients on 3+ medications who have a chronic medical condition.
2. **EMPOWER** for benzo deprescribing (<http://www.criugm.qc.ca/fichier/pdf/BENZOeng.pdf>)
3. **Algorithms and guidelines for discontinuing/tapering** (<https://deprescribing.org/>)
4. **STOPP/START tool**
(https://docs.wixstatic.com/ugd/2a1cfa_8ee866ed1cfb4f0681a5e422c1891f1a.pdf)
5. **Resources for studying:** UptoDate, Lexicomp, www.drugbank.com, Micromedex
6. Monthly **educational webcasts** on safe prescribing for older adults - [GeriMedRisk](#)
7. **Harmful medications** – AGS Beers Criteria
8. **GeriRx Files** – specific medication considerations for older patients

