DISCLOSURES

None of the faculty, planners, speakers, providers nor CME committee has any relevant financial relationships with commercial interest.

There is no commercial support for this CME activity.
Objectives

- Understand the prevalence of inappropriate medications use in the elderly
- Understand the effects of age on pharmacokinetics and pharmacodynamics
- Use evidence-based criteria (BEERS, STOPP, START) to evaluate for potentially adverse drug events in the elderly
- List potentially inappropriate medication classes in the elderly
- Develop a systematic approach to managing elderly patients with multiple medications, including principles of prescribing for older patients
Aging of the US Population

- **2000**
  - 65 yr or older: 88%
  - <65 yr: 12%

- **2030**
  - 65 yr or older: 80%
  - <65 yr: 20%
Elderly People

- Elderly use 3X more medications than younger patients
- Increased prevalence of ADE’s leading to an ↑ in drug related morbidity and mortality
- Unique medication needs of older people
- Elderly are not well represented in clinical trials
- Less is more
- Need to balance risk and benefit
Elderly Population and Medication 1/2

- Seniors represent around 13% of the population, but consume 40% of prescription drugs.
- By 2040, will be 25% of population, will buy 50% of prescription drug.
- 90% of community-dwelling seniors take at least one prescription medication.
- >20% of ambulatory older adults receive at least one potentially inappropriate medication.
15% to 25% of drug use in seniors is considered inappropriate or unnecessary.

ADE’s occur in 35% of community-dwelling older adults.

ADE’s are responsible for up to 28% of acute geriatric hospital admissions.

In nursing homes, $1.33 is spent on ADEs for every $1.00 spent on medications.
Don’t Forget OTC Meds

- Elderly Purchase 40% of OTCs
- Use of OTCs is 3-fold higher in elderly
- Nearly 15 billion spent each year on herbal products total
- Elderly use twice as much herbals
Why Geriatric Pharmacotherapy is Challenging

- More drugs are available each year
- FDA and off-label indications are expanding
- Formularies change frequently
- Drugs change from prescription to OTC
- Age-related changes, Pharmacokinetics & Pharmacodynamics
- Functional and Environmental Changes
Pharmacokinetics

- Absorption
- Distribution
- Metabolism
- Elimination
Absorption

- Route of administration
- What is taken with the drug
- Reduced intestinal blood flow
- Decreased rate of gastric emptying
- Alterations in gastric acidity
Distribution

- Decreased body water
- Increase adipose tissue
- Decreased lean body mass
- Decrease serum albumin -> increase amount of free drug -> drug toxicity
Metabolism

- Metabolic clearance of drugs by the liver may be reduced due to:
  - decreased hepatic blood flow
  - decreased liver size and mass

- Breakdown of drugs metabolized by Phase I pathways is reduced with aging
Elimination

- **Effect of aging:**
  - ↓renal blood flow
  - ↓renal size
  - ↓GFR and tubular secretory function

- Reduced elimination $\rightarrow$ drug toxicity
- Serum creatinine doesn’t reflect cr clearance
- Cockcroft-Gault Equation for estimating cr cl

\[
\text{Ideal weight in kg} \times \frac{(140 - \text{age})}{(72 \times \text{serum creatinine in mg/dL})} \times (0.85 \text{ if female})
\]
Pharmacodynamics

- **Age-related changes:**
  - ↑ sensitivity to sedation and psychomotor impairment with benzodiazepines
  - ↓ level and duration of pain relief with morphine
  - ↓ drowsiness with alcohol
  - ↓ HR response to beta-blockers
  - ↓ sensitivity to anti-cholinergic agents
Functional and Environmental Changes

- Visual impairment
- Hearing impairment
- ↑ rates of cognitive impairment
- Transportation barriers
- Complex dosing regimens
- Financial constraints
- Multiple prescribers
Case 1 (1 of 4)

- 87 yo F comes to the clinic because she has daytime fatigue, dizziness and worsening leg edema

- PMH: DM II with neuropathy, osteoporosis (hip fracture 1 year ago), hypertension, frequent falls, and urinary incontinence.

- Medication list: glipizide 5 mg q12h, propranolol 40 mg q12h 50 mg daily, pregabalin 300 mg q12h, alendronate 70 mg/week, lisinopril 2.5 mg daily and pioglitazone 15 mg daily
Case 1 (2 of 4)

- On examination, weight is 147lb (increased from 130lb over the past 6 months). BP is 140/75 mmHg.

- Over the past 3 months, blood pressure has ranged from 140 to 160 mmHg systolic and from 80 to 90 mmHg diastolic, with no orthostatic.

- A1C 8.0, Estimated cr clearance is 45 mL/min; it has declined over the past 6 months.
Case 1 (3 of 4)

Which of the following would address the patient’s most immediate need?

A. Increase Pioglitazone to 30 mg daily

B. Reduce pregabalin to 150 mg q12h.

C. Increase lisinopril to 10 mg daily.

D. Start furosemide 40 mg daily
Case 1 (4 of 4)

Which of the following would address the patient’s most immediate need?

A. Increase Pioglitazone to 30 mg daily
B. Reduce pregabalin to 150 mg q12h.
C. Increase lisinopril to 10 mg daily.
D. Start furosemide 40 mg daily
Polypharmacy = Negative Outcomes

- Overutilization
- Adverse Drug Events
- Poor Adherence

- Geriatric “Syndromes”
  - Urinary Incontinence
  - Cognitive Impairment
  - Loss of balance leading to falls/fractures
Adverse Drug Events

- Risk is 15% with two medications
- Risk increases to 58% with 5 meds
- Risk increases to 82% with ≥ 7 meds
- Additional medications lead to greater incidence of drug interactions
Risk Factors For ADE’s

- 6 or more concurrent chronic conditions
- 12 or more doses of drugs/day
- 9 or more medications
- Prior adverse drug event
- Low body weight or low BMI
- Age 85 or older
- Estimated CrCl < 50 mL/min
Drug – Drug Interactions Matter

- Drug – drug interactions ↑ with polypharmacy
- Age-related changes can lead to exaggerated interaction responses
- May contribute to ↑ morbidity and mortality
- Clinicians must be aware of relevant risks of commonly prescribed medication combinations
Medications Often Overlooked

- Aspirin
- Warfarin
- Insulin and Sulfonylureas
- Digoxin
- Anticholinergic
- Benzodiazepines
- Proton Pump Inhibitors (PPIs)
- Nonsteroidal Anti-inflammatory (NSAIDs)
- Antipsychotics
- Bisphosphonates
Case 2 (1 of 3)

- 84 yo Frail F, here first visit to your practice
- Recent fall with minor injuries at home.
- Her daughter reports her mother was walking back to the living room when she appeared to lose consciousness and fall.
- PMH: CHF, DM type 2 with neuropathy, CKI, Insomnia, Osteoporosis, Hypothyroidism, Osteoarthritis, Urinary Incontinence, GERD and constipation
Case 2 (2 of 3)

- PE:
  - Afebrile HR 85, RR 12, BP 135/70, no orthostatic
  - Exam unremarkable except skin tears
  - A1C 7.2
  - EKG – sinus rhythm
Case 2 (3 of 3) Med List:
- ASA 81 mg daily
- Oxybutynin ER 10 mg po once daily
- Omeprazole 40 mg po BID
- Gabapentin 300 mg po QID
- Diphenhydramine 25 mg QHS
- Iron 325 mg TID
- Levothyroxine 300 mcg daily
- Senna 2 tab po daily
- PEG 3350 Oral powder
- Meclizine 25 mg po once daily
- Digoxin 0.25 mg po daily
- Potassium Cl 20 mEq po once daily
- Glyburide 10 mg po BID
- Furosemide 40 mg po once daily
- Spironolactone 50 mg po once daily

Which medications attract your attention?

Risk Factors:
- ↑ # of meds
- ↑ # of conditions
- ↑ Age
- ↓ Creatinine clearance
- ↓ BMI
Overtreatment of diabetes in older adults

- Potential overtreatment of diabetes mellitus in older adults with tight glycemic control.

*Jama Internal Medicine*. 2015;175:356 - 362
Potential Overtreatment of Diabetes

- In 2014 there were more hospital admissions related to hypoglycemia than hyperglycemia.
- 25% of all ER/hospitalizations for ADE’s
- Undesirable health outcomes:
  - 3x risk of death/5 years
  - More CV events
  - Increased falls
Prescribing Cascade

Drug 1

ADE interpreted as new medical condition

Drug 2

ADE interpreted as new medical condition

Drug 3
I take Metformin for the diabetes caused by the Hydrochlorothiazide. I take for high blood pressure which I got from the Ambien. I take for insomnia caused by the Xanax. I take for the anxiety that I got from the Wellbutrin. I take for chronic fatigue which I got from the Lipitor. I take because I have high cholesterol because a healthy diet and exercise with regular chiropractic care and superior nutritional supplements are just too much trouble!
Case 3 (1 of 4)

- 78 yo M who presents for an urgent visit due to hypoglycemia.

- His diabetes has been well controlled (for past 2 yrs) on glipizide 5 mg daily, but he had a low sugar of 35 yesterday afternoon and last night.

- He was seen by your colleague 2 days ago with complaints of productive cough and worsening SOB.

- He was diagnosed with COPD exacerbation. He was prescribed SMX-TMP and prednisone burst and taper.

- PMH: DM II, HTN, COPD and chronic low back pain
Case 3 (2 of 4)

- Medication list: ASA 81 mg daily, losartan 50 mg daily, glipizide 5 mg daily, atorvastatin 40 mg daily, ibuprofen 400 mg q8h PRN, mg daily, tiotropium cap inhaled daily, albuterol PRN and SMX-TMP DS 1 tab twice a day for 7 days

- He reports he did not fill the prednisone because it made him jittery and caused poor sleep in the past.

- PE: Afebrile, HR 80, RR 12, BP 150/90, O2 sat 94% on room air. expiratory wheeze, otherwise unremarkable exam

- Labs: A1c 1 month ago 8.2
Case 3 (3 of 4)

What is the most likely cause of his hypoglycemia?

A. Unintentional overdose of glipizide
B. Interaction between tiotropium and glipizide
C. Interaction between SMX-TMP and losartan
D. Interaction between SMX-TMP and glipizide
Case 3 (4 of 4)

What is the most likely cause of his hypoglycemia?

A. Unintentional overdose of glipizide
B. Interaction between tiotropium and glipizide
C. Interaction between SMX-TMP and losartan
D. Interaction between SMX-TMP and glipizide
Hypoglycemia after antimicrobial drug prescription for older patients using sulfonylureas.

*JAMA Internal Medicine 2014;174:1605 -1612*
Hypoglycemia after antimicrobial drug prescription

<table>
<thead>
<tr>
<th>Drug 1/5</th>
<th>Odds Ration (94% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarithromycin</td>
<td>3.96 2.42-6.49</td>
</tr>
<tr>
<td>Levofloxacin</td>
<td>2.50 2.15-3.10</td>
</tr>
<tr>
<td>Sulfamethoxazole-trimethoprim</td>
<td>2.56 2.12-3.47</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>2.11 1.28-3.47</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>1.62 1.33-1.97</td>
</tr>
</tbody>
</table>
Hypoglycemia after antimicrobial drug prescription

- NNH Clarithromycin = 71
- These 5 responsible for 13% of all hypoglycemic episodes
- 28% of sulfonylurea users were prescribed one of these Antibiotics
### Table 2 | Antibiotic use and risk of sudden death within **seven days**

<table>
<thead>
<tr>
<th>Antibiotic use</th>
<th>No (%) cases</th>
<th>No (%) controls</th>
<th>Odds ratio (95% CI)</th>
<th>Adjusted odds ratio (95% CI)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin (reference)</td>
<td>226 (22.0)</td>
<td>1098 (29.4)</td>
<td>1.0 (reference)</td>
<td>1.0 (reference)</td>
</tr>
<tr>
<td>Co-trimoxazole</td>
<td>288 (28.0)</td>
<td>734 (19.7)</td>
<td>1.83 (1.50 to 2.24)</td>
<td>1.38 (1.09 to 1.76)</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>340 (33.1)</td>
<td>964 (25.8)</td>
<td>1.66 (1.37 to 2.00)</td>
<td>1.29 (1.03 to 1.62)</td>
</tr>
<tr>
<td>Norfloxacin</td>
<td>79 (7.7)</td>
<td>455 (12.2)</td>
<td>0.81 (0.61 to 1.08)</td>
<td>0.74 (0.53 to 1.02)</td>
</tr>
<tr>
<td>Nitrofurantoin</td>
<td>94 (9.2)</td>
<td>482 (12.9)</td>
<td>0.87 (0.66 to 1.15)</td>
<td>0.64 (0.46 to 0.88)</td>
</tr>
</tbody>
</table>

*Analysis adjusted for disease risk index.

BMJ 2014;349:g6196
Drug-Drug Interaction Lessons

- Watch carefully for hyperkalemia interactions with trimethoprim-sulfamethoxazole in high risk patients.
- Advancing age, diabetes, # of K+ ↑drugs, and renal impairment will increase risk.
- Use lowest possible dose, shortest duration, monitor.
- When clinically appropriate, alternative antibiotics should be considered.
Case 4 (1 of 4)

- 69 yo M with newly diagnosed Alzheimer’s brought to your office because he has been seeing his dead wife for the past 2 months

- History includes agitation and insomnia. Patient’s son is requesting a Rx for antipsychotic

- PMH: Dementia, HTN, CHF, depression, insomnia and HTN
Case 4 (2 of 4)

- PE: BP 145/90 mmHg. There are no tremors or other neurologic abnormalities.
- MOCA score 15 of 30
- Laboratory findings are normal.
- CT of the head shows mild cortical atrophy.
Case 4 (3 of 3) Med List:

- Paroxetine 20 mg at bedtime
- Atenolol 25 mg q12h
- Meclizine 25 mg daily
- Amitriptyline 25 mg at bedtime
- Digoxin 0.125 mcg daily

Which Meds has the highest anticholinergic burden?
## Anticholinergic Burden Scale

<table>
<thead>
<tr>
<th>ACB Score 1 = Possible Anticholinergic Effects</th>
<th>ACB Score 2 = Definite Anticholinergic Effects</th>
<th>ACB Score 3 = Anticholine Antagonist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alprazolam</td>
<td>Amantadine</td>
<td>Amitriptyline</td>
</tr>
<tr>
<td>Atarid</td>
<td>Amantadine</td>
<td>Brompheniramine</td>
</tr>
<tr>
<td>Diphenhydramine</td>
<td>Amantadine</td>
<td>Carbinoxamine</td>
</tr>
<tr>
<td>codeine</td>
<td>Cyproheptadine</td>
<td>Chlorpheniramine</td>
</tr>
<tr>
<td>Diazepam</td>
<td>Carbamazepine</td>
<td>Chlorpromazine</td>
</tr>
<tr>
<td>Digoxin</td>
<td>Loxapine</td>
<td>Cleparin</td>
</tr>
<tr>
<td>Furosemide</td>
<td>Meperidine</td>
<td>Clozapine</td>
</tr>
<tr>
<td>Prednisone</td>
<td>Molindone</td>
<td>Clozapine</td>
</tr>
<tr>
<td>Nifedipine</td>
<td>Oxcarbazepate</td>
<td>Dicyclomine</td>
</tr>
<tr>
<td>Warfarin</td>
<td>Pimozide</td>
<td>Darifenacine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Desipramine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diclofenac</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diphenhydramine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dimenhydrinate</td>
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<tr>
<td></td>
<td></td>
<td>Doxepin</td>
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<tr>
<td></td>
<td></td>
<td>Doxylamine</td>
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<tr>
<td></td>
<td></td>
<td>Eszopiclone</td>
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<tr>
<td></td>
<td></td>
<td>Flavoxate</td>
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<td></td>
<td></td>
<td>Hydroxyzine</td>
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<td></td>
<td></td>
<td>Hyoscymine</td>
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<tr>
<td></td>
<td></td>
<td>Imipramine</td>
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<tr>
<td></td>
<td></td>
<td>Meclazine</td>
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<tr>
<td></td>
<td></td>
<td>Meclizine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Methocarbamol</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nortriptyline</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Olanzapine</td>
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<tr>
<td></td>
<td></td>
<td>Oxazepam</td>
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<tr>
<td></td>
<td></td>
<td>Orphenadrine</td>
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<tr>
<td></td>
<td></td>
<td>Oxybutynin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paroxetine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perphenazine</td>
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<tr>
<td></td>
<td></td>
<td>Promethazine</td>
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<tr>
<td></td>
<td></td>
<td>Propantheline</td>
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<tr>
<td></td>
<td></td>
<td>Propiverine</td>
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<tr>
<td></td>
<td></td>
<td>Quetiapine</td>
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<tr>
<td></td>
<td></td>
<td>Scopolamine</td>
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<tr>
<td></td>
<td></td>
<td>Solifenacine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thoridazine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tolterodine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trifluoperazine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trihexyphenidyl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trimipramine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trihexyphenidyl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trimipramine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trihexyphenidyl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tropium</td>
</tr>
</tbody>
</table>

www.agingbraincare.org

### Table 3. Association of Incident Dementia and AD With 10-Year Cumulative Anticholinergic Use

<table>
<thead>
<tr>
<th>Diagnosis, TSDDb</th>
<th>Follow-up Time, Person-years</th>
<th>No. of Events</th>
<th>HR (95% CI) Unadjustedc,d</th>
<th>HR (95% CI) Adjustedd,e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dementia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>5618</td>
<td>136</td>
<td>1 [Reference]</td>
<td>1 [Reference]</td>
</tr>
<tr>
<td>1-90</td>
<td>7704</td>
<td>203</td>
<td>0.96 (0.77-1.20)</td>
<td>0.92 (0.74-1.16)</td>
</tr>
<tr>
<td>91-365</td>
<td>5051</td>
<td>172</td>
<td>1.31 (1.04-1.65)</td>
<td>1.19 (0.94-1.51)</td>
</tr>
<tr>
<td>366-1095</td>
<td>2626</td>
<td>102</td>
<td>1.39 (1.07-1.82)</td>
<td>1.23 (0.94-1.62)</td>
</tr>
<tr>
<td>&gt;1095</td>
<td>4022</td>
<td>184</td>
<td>1.77 (1.40-2.23)</td>
<td>1.54 (1.21-1.96)</td>
</tr>
</tbody>
</table>

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JAMA Intern Med 2015;173(3); 401-7
### Antipsychotic adverse outcomes

**Association between new use of atypical antipsychotic drugs (AAPs) and adverse outcomes in older adults**

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Event rates</th>
<th>At 90 d after prescription date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AAPs</td>
<td>No AAPs</td>
</tr>
<tr>
<td>Acute kidney injury</td>
<td>1.02%</td>
<td>0.62%</td>
</tr>
<tr>
<td>All-cause mortality</td>
<td>6.82%</td>
<td>3.05%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1.73%</td>
<td>1.16%</td>
</tr>
<tr>
<td>Acute myocardial infarction</td>
<td>0.67%</td>
<td>0.50%</td>
</tr>
<tr>
<td>Hypotension</td>
<td>0.39%</td>
<td>0.22%</td>
</tr>
<tr>
<td>Acute urinary retention</td>
<td>0.34%</td>
<td>0.17%</td>
</tr>
<tr>
<td>Ventricular arrhythmia</td>
<td>0.22%</td>
<td>0.15%</td>
</tr>
<tr>
<td>Rhabdomyolysis or the neuroleptic malignant syndrome</td>
<td>0.10%</td>
<td>0.07%</td>
</tr>
</tbody>
</table>

*OR = odds ratio; CI defined in Glossary.
†Outcomes were hospitalization events except for all-cause mortality.
‡OR was interpreted as a risk ratio by the authors and adjusted for local health integration network (geographically defined health authorities in Ontario).
Antipsychotic adverse outcome

Table 2. Fractures and Falls Occurring Within 90 Days of Starting to Take an Atypical Antipsychotic Medication

<table>
<thead>
<tr>
<th>Type of Injury</th>
<th>Atypical Antipsychotic Drug (n = 97,777)</th>
<th>None (n = 97,777)</th>
<th>Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fracture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonvertebral osteoporotic³</td>
<td>2462 (2.5)</td>
<td>1651 (1.7)</td>
<td>1.51 (1.41-1.60)</td>
</tr>
<tr>
<td>Hip</td>
<td>1459 (1.5)</td>
<td>883 (0.9)</td>
<td>1.67 (1.53-1.81)</td>
</tr>
<tr>
<td>All³</td>
<td>6886 (7.0)</td>
<td>5429 (5.5)</td>
<td>1.29 (1.24-1.34)</td>
</tr>
<tr>
<td>Fall³</td>
<td>4314 (4.4)</td>
<td>2858 (2.9)</td>
<td>1.54 (1.47-1.61)</td>
</tr>
</tbody>
</table>

I smile to hide
how completely
overwhelmed
I am.
Age-Associated changes
Pharmacokinetics
Pharmacodynamics
Increase in co-morbidities

+ 

Increased susceptibility to:
Polypharmacy
Drug interactions
Adverse drug events
Prescribing cascade
Nonadherence
Potentially inappropriate prescribing
What tools are available?

If you've been diagnosed with polypharmacy, don't you worry.

We've got a pill for that.

Oh, you must work in a hospital too.

Original crude med-ecard humor from The Happy Hospitalist Blog
What tools are available?

- BEERS criteria
- STOPP / START
- Medication Appropriateness Index
- ARMOR Tool
BEERS CRITERIA

- Updated in 2015 by the American Geriatrics Society
- Intend to improve drug selection and reduce exposure to potentially inappropriate medications in older adults

Beers Goals:
- Improve care by decreasing use of potentially inappropriate medications (PIMS)
- Educational tool
- Quality measure
- Research tool
Beers Criteria 2015 Update

- Table 1: Quality and strength of evidence
- Table 2: Potentially inappropriate medications
- Table 3: Drug/disease state interactions
- Table 4: Drugs to use with caution
- Table 5: Drug/drug interactions
- Table 6: Renal dosing
- Table 7: Drugs with strong anticholinergic properties

available at GeriatricsCareOnline.org
Table 2: Potentially Inappropriate Meds

- Avoid **Amiodarone** as first-line therapy for A. Fib unless the patient has CHF or substantial LV hypertrophy.

- Avoid **Digoxin** as first-line therapy for A Fib, also as first-line therapy for heart failure. Avoid dosages >0.125 mg/d.

- Avoid **Nitrofurantoin** in individuals with cr cl <30 mL/min or for long-term suppression of bacteria.

- Avoid **PPI** for >8 weeks duration unless for high-risk patients (eg, chronic NSAID use), erosive or Barrett’s esophagitis.
<table>
<thead>
<tr>
<th>Specific Condition</th>
<th>Exacerbating medications to avoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHF</td>
<td>NSAIDs, COX-2 inhibitors, Nondihydropyridine CCBs (diltiazem, verapamil) and Thiazolidinediones (pioglitazone, rosiglitazone)</td>
</tr>
<tr>
<td>Syncope</td>
<td>Acetylcholinesterase inhibitors (AChEIs), Peripheral alpha-1 blockers, Tertiary TCAs and Antipsychotics</td>
</tr>
<tr>
<td>Dementia</td>
<td>Anticholinergics, Benzodiazepines H2-receptor antagonists, Z-Drugs (Eszopiclone, Zolpidem, Zaleplon) and Antipsychotics,</td>
</tr>
<tr>
<td>Delirium</td>
<td>Anticholinergics, Antipsychotics, Benzodiazepines, Corticosteroids, H2-receptor antagonists, Meperidine and hypnotics</td>
</tr>
<tr>
<td>Seizures</td>
<td>Bupropion Chlorpromazine Clozapine, Olanzapine, Tramadol</td>
</tr>
<tr>
<td>Ho Falls or Fractures</td>
<td>Anticonvulsants, Antipsychotics, Benzodiazepines, Z-Drugs, TCAs SSRIs and Opioids</td>
</tr>
<tr>
<td>Parkinson disease</td>
<td>All antipsychotics (except aripiprazole, quetiapine, clozapine) Antiemetics (Metoclopramide, Prochlorperazine, Promethazine)</td>
</tr>
</tbody>
</table>
Table 5: Drug-Drug Interactions

<table>
<thead>
<tr>
<th>Object Drug/Class</th>
<th>Interacting Drug/Class</th>
<th>Rationale</th>
<th>Recommendation</th>
<th>Quality of Evidence</th>
<th>Strength of Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha-1 blockers,</td>
<td>Loop diuretics</td>
<td>↑ risk of urinary incontinence in older women</td>
<td>Avoid in older women, unless conditions warrant both drugs</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td>peripheral</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACEIs</td>
<td>Amiloride or triamterene</td>
<td>↑ risk of hyperkalemia</td>
<td>Avoid routine use; reserve for patients with demonstrated hypokalemia while on an ACEI</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td>Anticholinergic</td>
<td>Anticholinergic</td>
<td>↑ risk of cognitive decline</td>
<td>Avoid, minimize the number of anticholinergic drugs (see Table 8).</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td>Antidepressant</td>
<td>*Two or more other CNS drugs</td>
<td>↑ risk of falls</td>
<td>Avoid 3 or more CNS drugs, minimize the number of CNS drugs.</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
</tbody>
</table>
### Table 5: Drug-Drug Interactions

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<thead>
<tr>
<th>Object Drug/Class</th>
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<th>Strength of Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antipsychotic</td>
<td>*Two or more other CNS drugs</td>
<td>↑ risk of falls</td>
<td>Avoid 3 or more CNS drugs, minimize the number of CNS drugs.</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td>Benzodiazepines and benzodiazepine-receptor agonists</td>
<td>*Two or more other CNS drugs</td>
<td>↑ risk of falls/fracture s</td>
<td>Avoid 3 or more CNS drugs, minimize the number of CNS drugs.</td>
<td>High</td>
<td>Strong</td>
</tr>
<tr>
<td>Corticosteroids</td>
<td>NSAIDs</td>
<td>↑ risk of peptic ulcer disease/GI bleed</td>
<td>Avoid; if not possible, provide GI protection.</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td>Lithium</td>
<td>ACEIs</td>
<td>↑ toxicity</td>
<td>Avoid, monitor lithium concentrations.</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td>Lithium</td>
<td>Loop diuretic</td>
<td>↑ toxicity</td>
<td>Avoid, monitor lithium concentrations.</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
</tbody>
</table>
### Table 6: Renal Dosing

<table>
<thead>
<tr>
<th>Medication Class/Medication</th>
<th>Creatinine Clearance (mL/min) When Action Required</th>
<th>Rationale</th>
<th>Recommendation</th>
<th>Quality of Evidence</th>
<th>Strength of Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cardiovascular/Hemostasis</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amiloride</td>
<td>&lt;30</td>
<td>↑ potassium and ↓ sodium</td>
<td>Avoid</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td>Apixaban</td>
<td>&lt;15</td>
<td>↑ bleeding</td>
<td>Avoid</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td>Dabigatran</td>
<td>&lt;30</td>
<td>↑ bleeding</td>
<td>Avoid</td>
<td>High</td>
<td>Strong</td>
</tr>
<tr>
<td>Edoxaban</td>
<td>30–50</td>
<td>↑ bleeding</td>
<td>Reduce dose</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>&lt;30</td>
<td></td>
<td>Avoid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enoxaparin</td>
<td>&lt;30</td>
<td>↑ bleeding</td>
<td>Reduce dose</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td>Fondaparinux</td>
<td>&lt;30</td>
<td>↑ bleeding</td>
<td>Avoid</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>30–50</td>
<td>↑ bleeding</td>
<td>Reduce dose</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>&lt;30</td>
<td></td>
<td>Avoid</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 6: Renal Dosing

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Cardiovascular/Hemostasis</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spironolactone</td>
<td>&lt;30</td>
<td>Hyperkalemia</td>
<td>Avoid</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td>Triamterene</td>
<td>&lt;30</td>
<td>Increased risk of kidney injury; ↑ potassium and ↓ sodium</td>
<td>Avoid</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td><strong>Central Nervous System/Analgesics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duloxetine</td>
<td>&lt;30</td>
<td>↑ GI adverse effects (nausea, diarrhea)</td>
<td>Avoid</td>
<td>Moderate</td>
<td>Weak</td>
</tr>
<tr>
<td>Gabapentin</td>
<td>&lt;60</td>
<td>CNS adverse effects</td>
<td>Reduce dose</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td>Levetiracetam</td>
<td>≤80</td>
<td>CNS adverse effects</td>
<td>Reduce dose</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td>Pregabalin</td>
<td>≤60</td>
<td>CNS adverse effects</td>
<td>Reduce dose</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td>Tramadol</td>
<td>&lt;30</td>
<td>CNS adverse effects</td>
<td>Immediate release: reduce dose Extended release: avoid</td>
<td>Weak</td>
<td>Weak</td>
</tr>
</tbody>
</table>
STOPP Criteria

- Screening Tool of Older persons Potentially inappropriate Prescriptions

- Arranged by physiological system

- Highlight drug class duplication, drug-drug interactions, and drug-disease interactions

STOPP Criteria Examples A. Cardiovascular System

- Digoxin at a long-term dose > 125µg/day with impaired renal function (*increased risk of toxicity*).
- Loop diuretic as first-line monotherapy for hypertension (*safer, more effective alternatives available*).
- Thiazide diuretic with a history of gout (*may exacerbate gout*).
- Non-cardioselective beta-blocker with COPD (*risk of bronchospasm*).
- Use of diltiazem or verapamil with NYHA Class III or IV heart failure (*may worsen heart failure*).
- Calcium channel blockers with chronic constipation (*may exacerbate constipation*).
STOPP Criteria Examples B. CNS & Psychotropic Drugs.

- TCAs with dementia, narrow angle glaucoma, cardiac conduction abnormalities, or prior history of urinary retention (risk of worsening these conditions).
- Initiation of TCAs as first-line antidepressant treatment (higher risk of adverse drug reactions with TCAs than with SSRIs or SNRIs).
- SSRI’s with current or recent significant hyponatraemia i.e. Na+ < 130 mmol/l (risk of exacerbating or precipitating hyponatraemia).
- Benzodiazepines for ≥ 4 weeks (no indication for longer treatment; risk of prolonged sedation, confusion, impaired balance, falls, road traffic accidents; all benzodiazepines should be withdrawn gradually if taken for more than 4 weeks as there is a risk of causing a benzodiazepine withdrawal syndrome if stopped abruptly).
- Antipsychotics (i.e. other than quetiapine or clozapine) in those with parkinsonism or Lewy Body Disease (risk of severe extra-pyramidal symptoms)
START Criteria

- Screening Tool to Alert doctors to the Right Treatment

- Highlight under-prescription or omission of clinically indicated, evidence-based medicine

- Arranged according to physiological system

START Criteria Examples A. Cardiovascular Syst.

- Vitamin K antagonists or direct thrombin inhibitors or factor Xa inhibitors in the presence of chronic atrial fibrillation.

- Aspirin (75 mg – 160 mg once daily) in the presence of chronic atrial fibrillation, where Vitamin K antagonists or direct thrombin inhibitors or factor Xa inhibitors are contraindicated.

- Antiplatelet therapy (aspirin or clopidogrel or prasugrel or ticagrelor) with a documented history of coronary, cerebral or PVD

- Beta-blocker with ischaemic heart disease.

- Statin therapy with a documented history of coronary, cerebral or peripheral vascular disease, unless the patient’s status is end-of-life or age is > 85 years.

- Angiotensin Converting Enzyme (ACE) inhibitor with systolic heart failure and/or documented coronary artery disease.
## Medication Appropriateness Index

<table>
<thead>
<tr>
<th>Questions</th>
<th>Appropriate 1</th>
<th>Marginally appropriate 2</th>
<th>Inappropriate 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Is there an indication for the drug?</td>
<td>Indicated</td>
<td>Not indicated</td>
<td></td>
</tr>
<tr>
<td>2  Is the medication effective for the condition?</td>
<td>Effective</td>
<td>Ineffective</td>
<td></td>
</tr>
<tr>
<td>3  Is the dosage correct?</td>
<td>Correct</td>
<td>Incorrect</td>
<td></td>
</tr>
<tr>
<td>4  Are the directions correct?</td>
<td>Correct</td>
<td>Incorrect</td>
<td></td>
</tr>
<tr>
<td>5  Are the directions practical?</td>
<td>Practical</td>
<td>Impractical</td>
<td></td>
</tr>
<tr>
<td>6  Are there clinically significant drug-drug interactions?</td>
<td>Insignificant</td>
<td>Significant</td>
<td></td>
</tr>
<tr>
<td>7  Are there clinically significant drug-disease interactions?</td>
<td>Insignificant</td>
<td>Significant</td>
<td></td>
</tr>
<tr>
<td>8  Is there unnecessary duplication with other drugs?</td>
<td>Necessary</td>
<td>Unnecessary</td>
<td></td>
</tr>
<tr>
<td>9  Is the duration of therapy acceptable?</td>
<td>Acceptable</td>
<td>Not acceptable</td>
<td></td>
</tr>
<tr>
<td>10 Is this drug the least expensive alternative compared with others of</td>
<td>Least expensive</td>
<td>Most expensive</td>
<td></td>
</tr>
<tr>
<td>equal utility?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Is there an omission of a needed drug for an active disease or condition?</td>
<td>No drug omitted</td>
<td>Drug omitted</td>
<td></td>
</tr>
</tbody>
</table>

## ARMOR Tool

| A | Assess | - Beers Criteria  
|   |        | - Beta blockers, Pain medications 
|   |        | - Antidepressants, Antipsychotics |
| R | Review | - Drug–Drug interactions  
|   |      | - Drug–disease interactions  
|   |      | - Adverse drug reactions |
| M | Minimize | - Number of medications according to functional status rather than evidence-based medicine |
| O | Optimize | - For renal/hepatic clearance, PT/PTT, beta-blockers, anticonvulsants, pain medications, and hypoglycemics; GDR for antidepressants |
| R | Reassess | - Functional/ cognitive status  
|   |  | - Clinical status and medication compliance |

“Each capsule contains your medication plus a treatment for each of its side effects.”
Steps to Optimize Prescribing in the Elderly

**Step 1:** Brown Bag Biopsy…Reconcile

**Step 2:** Determine medication Appropriateness, Match meds to medical conditions …Prescribing “start low, go slow”

**Step 3:** Deprescribing…The clean up Identify and discontinue inappropriate meds
Interdisciplinary Geri Team

- Family Members
- Medical Attending
- Patient
- Medical Social Worker
- Pharmacist Attending
- Trainees (Medical/Pharmacy Residents)
Brown Bag Biopsy & Medication History

- Have patient to bring in all medications at each visit
- Get a complete medication history
- Is the drug being given correctly? dose, route, frequency
- Match problem list with drug list
- Is appropriate for the patient?
- Are any symptoms/complaints related to drug therapy?
Steps Before Prescribing a New Drug 1/2:

- Is this medication necessary?
- What are the therapeutic end points?
- Make certain the drug being prescribed has a clinical indication?
- Do the benefits outweigh the risks?
- Understand age-related physiological changes
- Interpret the evidence
Steps Before Prescribing a New Drug 2/2:

- Could it interact with diseases, other drugs?
- Know the side-effect profile of the drugs being prescribed.
- Be aware of the prescribing cascade!!! Is it used to treat effects of another drug?
- Could 1 drug be used to treat 2 conditions?
- Consider treatment complexity and feasibility
- Nonadherence
Principles of Prescribing

- Start with a low dose
- Titrate upward slowly, as tolerated by the patient
- Consider length of therapy, dosing schedule and cost
- Look for duplicate therapies or pharmacologic effect
- Eliminate unnecessary medications and simplify dosing regimens
- Always consider non-pharmacologic therapy
Medication Clean-up / Deprescribing 1/2

- IF the medication is not effective or not indicated -> Stop the medication
- Targets the correct condition
- IF the medication is overprescribed -> Stop medication or decrease the dose
- Don’t go cold turkey
- IF the medication is potentially inappropriate -> Switch to a safer alternative
- Discontinue all PRN medications that have not been used in >1 month
Medication Clean-up / Deprescribing 2/2

- Discontinue, communicate with patient and other providers

- Transition of care !!! Evaluate indication and use in post-acute setting

- Achieve balance between over- and underprescribing

- Less is more

- What is the endpoint of therapy?

**Failure in any one of these**
**Can result in adverse drug events (ADEs)**
Reasons to start

Reasons to continue

Reasons to stop

How to stop
Take Home Messages

- Consider whether drug therapy is necessary
- ADEs are common but can be minimized
- Recognize BEERS/STOPP list medications
- Assist patients with adherence
- Prioritize therapeutic goals
- Elicit patient values and preferences
- Consider remaining life expectancy, quality of life, and functional status
“To do nothing is sometimes a good remedy” (Hippocrates)

Thank you !!!
w.hamade@ruhealth.org