MEDICATION MANAGEMENT IN THE OLDER ADULT

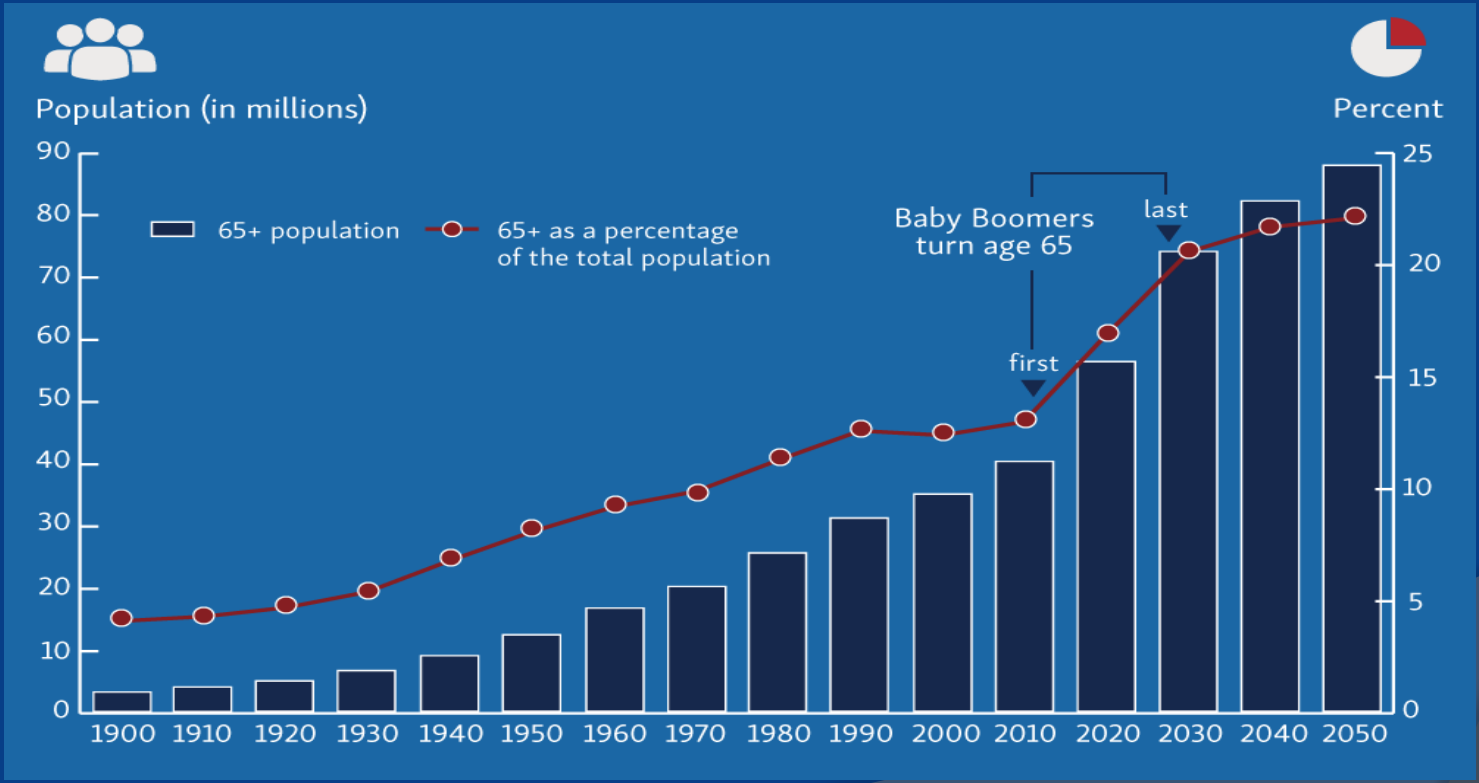
Rebecca Rottman-Sagebiel, Pharm.D., BCPS
Sharon Jung Tschirhart, Pharm.D., BCPS
Geriatric Clinical Pharmacy Specialists
STVHCS, Audie L. Murphy Division
Clinical Assistant Professors, University of Texas/UTHSCSA

Presentation Objectives

- Identify key issues in geriatric pharmacology, including effects of age on pharmacokinetics
- Summarize principles of prescribing for older adults
- Understand polypharmacy and precipitators and consequences
- Understand the Beers and STOPP/START Criteria

Projections of Individuals over 65

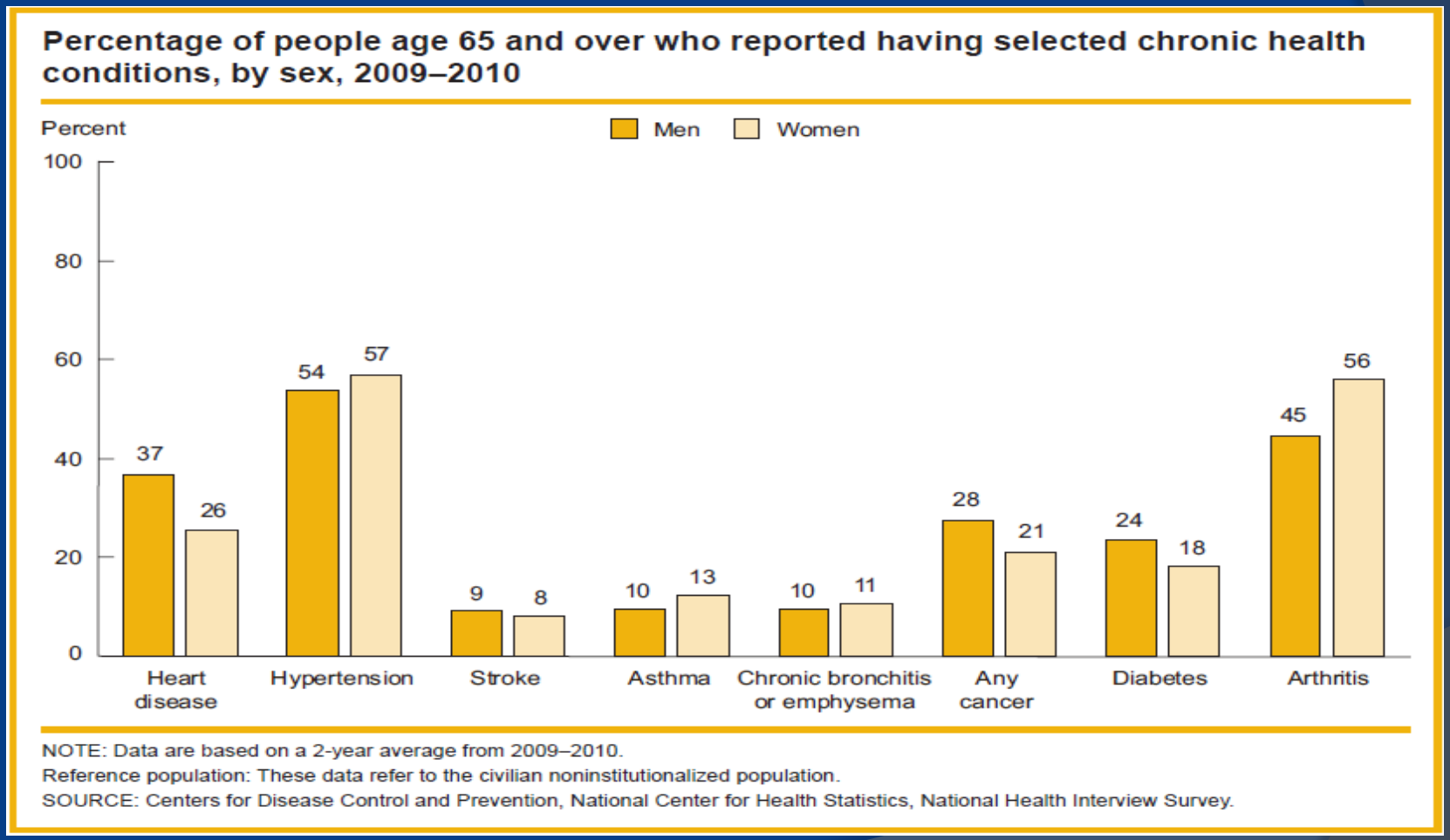
- In 1990, there were 31.2 million individuals over the age of 65
- In 2050, estimates suggest there will be almost 90 million Americans over the age of 65



Federal Interagency Forum on Aging-Related Statistics

https://agingstats.gov/infographics.html; accessed 8-23-18

Chronic Conditions in the Elderly



Federal Interagency Forum on Aging-Related Statistics

https://agingstats.gov/docs/PastReports/2012/OA2012.pdf; accessed 8-23-18

Pharmacokinetics in the Elderly

- Influenced by the following factors:
  - acute and chronic illness
  - concomitant medications
  - nutritional status
  - chronological age (loss of organ reserve)
- Absorption, Distribution, Metabolism, Excretion

Pharmacokinetics of Aging

Absorption	↑ gastic pH as ↓ gastric acid secretion ↓ absorptive surface ↓ gastric and splanchnic blood flow ↓ gastrointestinal motility & emptying rate ↓ intrinsic factor slower rate, but usually same extent of absorption

Drugs and Aging 2005; 22 (5): 375-392
Br J Clin Pharmacol 2004; 58 (5): 452-469
Eur J Clin Pharmacol 2008 64:183–199

Pharmacokinetics of Aging

Distribution	↓ cardiac output ↓total body weight, lean body weight ↓ total body water ↑ body fat perfusion ↓ albumin ↓ relative tissue ↑ peripheral vascular resistance ↓ Vd of water soluble drugs (i.e. digoxin, lithium) leading to ↑ peak concentration ↑ Vd of lipid soluble drugs (i.e. diazepam) leading to prolonged half-lives and duration of action

Drugs and Aging 2005; 22 (5): 375-392
Br J Clin Pharmacol 2004; 58 (5): 452-469
Eur J Clin Pharmacol 2008 64:183–199

Pharmacokinetics of Aging

Metabolism	↓ liver mass ↓ hepatic blood flow ↓ enzyme activity possible ↓ in phase I activity (hydroxylation, oxidation, reduction) no change in phase II activity ↑ systemic bioavailability of drugs undergoing first pass metabolism

Drugs and Aging 2005; 22 (5): 375-392
Br J Clin Pharmacol 2004; 58 (5): 452-469
Eur J Clin Pharmacol 2008 64:183–199

Pharmacokinetics of Aging

Elimination	↓ renal blood flow ↓ glomerular filtration rate (creatinine clearance) ↓ renal elimination of drugs ↓ tubular secretion ↓ renal mass

Drugs and Aging 2005; 22 (5): 375-392
Br J Clin Pharmacol 2004; 58 (5): 452-469
Eur J Clin Pharmacol 2008 64:183–199

Calculations for Drug Elimination

Cockcroft-Gault (CCG) Equation

CrCl units= mL/min

Male:

$$CrCl = \frac{(140-age)(weight\ in\ kg)}{72 \times serum\ creatinine\ (mg/dl)}$$

Female:

CrCl = 0.85 x calculation for males

Modification of Diet in Renal Disease (MDRD) Equation*

GFR units = $mL/min/1.73m^2$

$$GFR = 170\,[P_{CR}]^{-0.999} \times [Age]^{-0.176} \times [SUN]^{-0.170} \times [Alb]^{+0.318} \times 0.762 \text{ if patient female} \times 1.180 \text{ if patient black}$$

*Not validated in the geriatric population

*eGFR has not been validated in adults over the age of 70 years

http://www.nkdep.nih.gov/lab-evaluation/gfr-calculators.shtml; accessed 8-23-18

http://www.nephron.com/cgi-bin/CGSI.cgi; accessed 8-23-18

Ideal and Adjusted Body Weight

- IBWt:
  - Male = 50 kg + 2.3 kg (each inch > 5 ft)
  - Female = 45.5 kg + 2.3 kg (each inch > 5 ft)

- ABWt = IBWt + (Measured wt - IBWt) x 0.4
  - Calculation should only be used when actual body weight is >20 to 25% IBWt

http://www.globalrph.com/ibw_calc.htm; accessed 8-23-18

Pharmacodynamics of Aging

- ↑ Central nervous system sensitivity
- ↑ Anticholinergic sensitivity (cognitive impairment, vision changes, urinary retention, constipation and dry mouth)
- ↓ Adrenergic receptor response
- Impaired baroreceptor reflex activity

Drugs and Aging 2005; 22 (5): 375-392
Br J Clin Pharmacol 2004; 58 (5): 452-469

Multiple Choice Question

- The absorption of metoprolol _____ in the older patient.

  a. is increased

  b. is decreased

  c. stays the same

Multiple Choice Question (continued)

- The absorption of metoprolol _____ in the older patient.

  a. is increased

  b. is decreased

  c. stays the same

What is Polypharmacy?

- The use of a number of different drugs, possibly prescribed by different doctors and filled in different pharmacies, by a patient who may have one or several health problems
- Taking multiple medications
- Taking at least one medication not clinically indicated

Clin Geriatr Med 2012; 28:173-186
Drugs Aging 2011; 28(7):509-518
J Am Acad Nurse Pract 2005;17:123-132
http://www.nlm.nih.gov/medlineplus/seniorshealth.html; accessed 8-23-18

Drug Utilization

- Community-based elderly
  - take an average of 2 to 9 prescription medications daily
  - almost 90% take ≥ 1 OTC medication
  - almost 50% take 2 to 4 OTC medications
  - 47 to 59% take a vitamin or mineral
  - 11 to 14% take herbal supplements

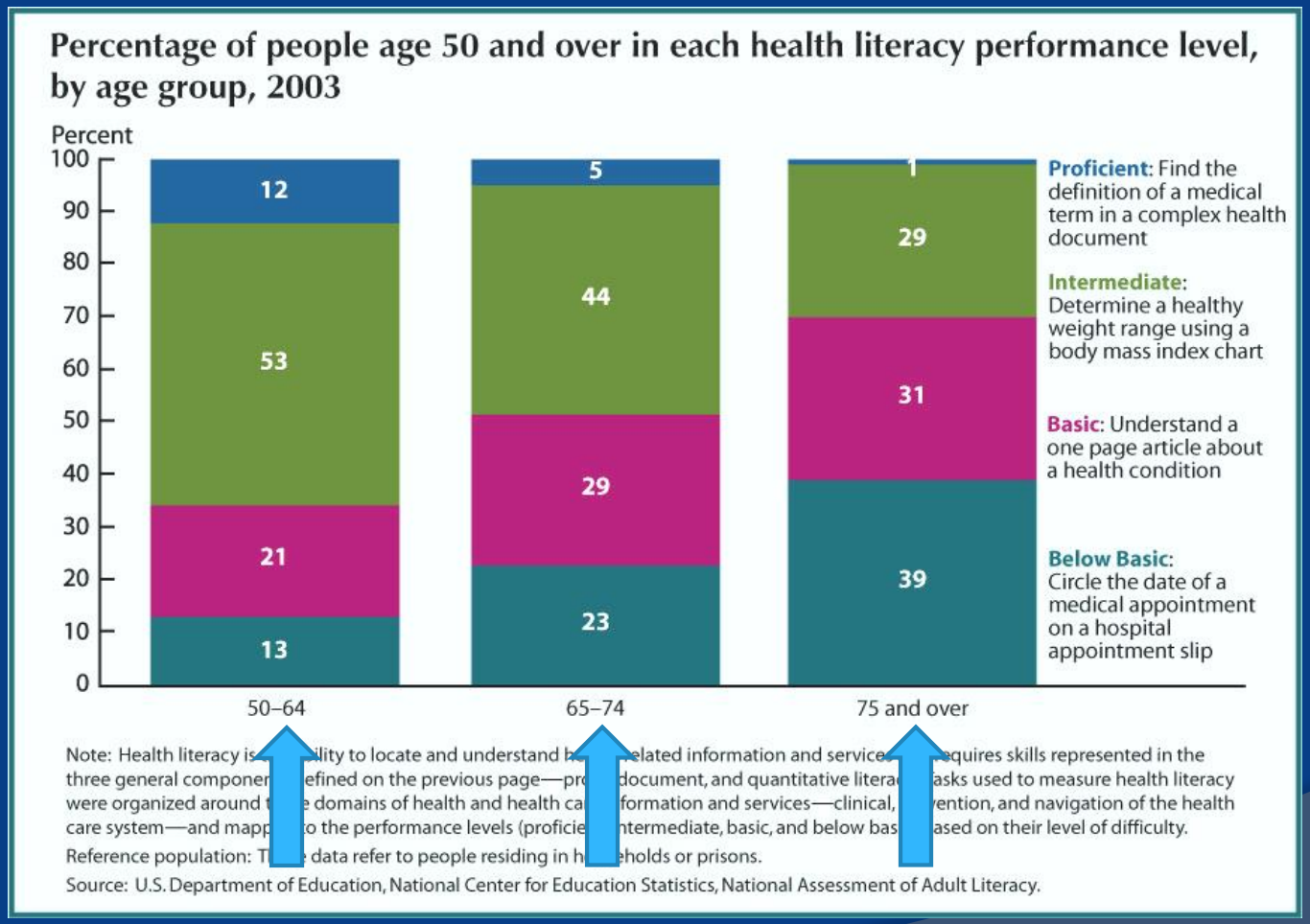
Am J Geriatr Pharmacother 2007;5:345-51

Medication Adherence in the Elderly

- 20-50% are non-adherent to medications
  - Intentional
    - Individual reasoning of risk vs. benefit
    - Acceptance of diagnosis
  - Unintentional
    - Sociodemographic
    - Physical barriers

Eur J Clin Pharmacol (2008) 64:183–199

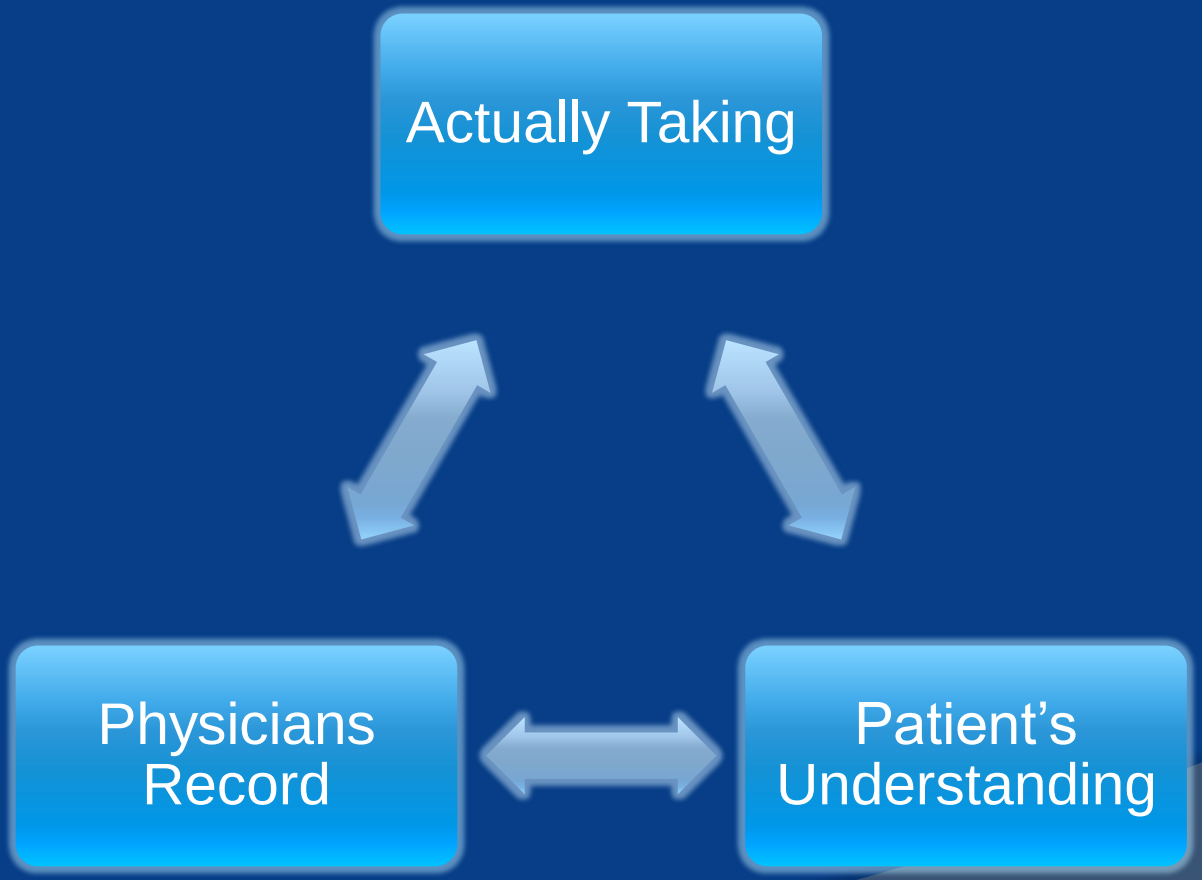
Literacy Performance Levels



Federal Interagency Forum on Aging-Related Statics (2008 Report)

https://agingstats.gov/docs/PastReports/2008/OA2008.pdf; accessed 8-23-18

Medication Disconnect



JAMA 2010; 304(14):1592-1601

Patient Perception of Medication

- Medications taken OTC are considered safe and you can take as many as you need
- Herbal medicine is all natural so it doesn't interfere with any prescription or OTC medications
- Vitamins can't hurt you and will only give you energy
- Medications are better if they cost more and are newer
- It's okay to only take half of the medication, because it is expensive and will last longer
- If I run out of my medicine it is okay to borrow some other medication that my friend/spouse/neighbor takes

JAMA 2002; 287 (3): 337-344

Obtaining a Medication History

- Asking opened ended questions:
  - How do you take your medications?
  - What are the names of your medications?
  - How many times a day do you take your medications?
  - What other pharmacies fill your medications?
  - How many doctors do you see and what do you see them for?
- Be sure to inquire about over-the-counter and herbal medications, vitamins and illicit drugs
- Assess medication adherence

Am J Health-Syst Pharm. 2004; 61:1689-95

Joint Commission Resources and the American Society of Health-System Pharmacists Medication Reconciliation Handbook. Chapter 5: Educating your staff. Oakbrook Terrace, IL: Joint Commission Resources, 2006

Obtaining Medication History (cont.)

- Examples
  - Have you ever stopped taking medications because you were feeling better?
  - Have you ever stopped taking medications because you felt worse?
  - Have you ever been careless with your medications (i.e. double doses, adjust medications without physician recommendation, etc.)?
  - How often do you forget to take your medications?

Interventions to Improve Adherence

- Verbal medication counseling
- Written medication information
- Behavioral/educational interventions
- Memory devices
- Audiovisual techniques
- Telephone-linked reminder systems
- Self-medication programs

Am J Health System Pharm 2003 Apr 1;60(7):657-65
Drugs Aging 2003;20(3):229-40
Ann Pharmacother. 1993 Jan;27(1):80-6

Multiple Choice Question

Which of the following is an example of polypharmacy in an older adult:

a. Glyburide 5 mg qAM in a patient with stage 4 CKD

b. Quetiapine 25 mg QHS for sleep

c. Omeprazole 20 mg daily for chronic use (>90 days)

d. All of the above

Multiple Choice Question

Which of the following is an example of polypharmacy in an older adult:

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Adverse Drug Reactions (ADRs)

- CDC reports older adults are
  - Twice as likely as others to come to emergency departments for adverse drug events
  - Seven times more likely to be hospitalized after an emergency visit
- Some studies suggest 3-17% of hospital admissions
- Some studies suggest a 20% prevalence of ADRs found in elderly patients admitted to the hospital

Drugs and Aging 2005; 22 (5): 375-392
Pharmacoeconomics 2003; 21(9): 623-650
N Engl J Med 2011; 365:2002-2012
Clin Geriatr Med. 2010;26(4):583-605
http://www.ahrq.gov/research/findings/factsheets/errors-safety/aderia/index.html; accessed 8-23-18
https://www.cdc.gov/medicationsafety/basics.html; accessed 8-23-18

Adverse Drug Reactions (ADRs)

- ADRs increase average length of stay by ~8-12 days
- Post ADR cost $2284-$3093 (2000)
- Direct cost to US: $1.56-$5.6 billion
- Preventable ADRs: 28-95% potential reduction
  - Warfarin, insulins, oral antiplatelet agents and oral hypoglycemic agents

Drugs and Aging 2005; 22 (5): 375-392
Pharmacoeconomics 2003; 21(9): 623-650
N Engl J Med 2011; 365:2002-2012
Clin Geriatr Med. 2010;26(4):583-605
http://www.ahrq.gov/research/findings/factsheets/errors-safety/aderia/index.html; accessed 8-23-18
https://www.cdc.gov/medicationsafety/basics.html; accessed 8-23-18

Risk Factors for ADRs in the Elderly

- Reduction in Adaptation
- Frailty
- Decompensation
- Falls
- Number of Medications
- Pharmacokinetic Interactions
- Compliance/Adherence

Drugs and Aging 2005; 22 (5): 375-392

Prevention of ADRs in the Elderly

- Evaluate co-morbidities, frailty, cognitive function
- Look for family members and caregivers able to take responsibility for drug administration
- Evaluate renal function and adapt medication therapy as appropriate
- Monitor medication effects
- Recognize clinical sign or symptom that could be associated with an adverse effect and that the effect doesn't necessarily need to be treated with an additional medication

Drugs and Aging 2005; 22 (5): 375-392
J Am Geriatr Soc. 2011;59(4):615-621
Am Fam Physician. 2013 Mar 1;87(5):331-336

Prevention of ADRs in the Elderly

- Evaluate need to modify medication regimen
- Keep number of agents prescribed to minimum
- Adapt treatment to patient's life expectancy
- Recognize that self-medication and non-compliance are common and can induce ADRs

Drugs and Aging 2005; 22 (5): 375-392
J Am Geriatr Soc. 2011;59(4):615-621
Am Fam Physician. 2013 Mar 1;87(5):331-336

Interventions to Reduce Potentially Inappropriate Medication Use

- Explicit Criteria (criterion based)
  - Designed to be a universal minimum standard that applies to all patients
  - i.e. Beers Criteria, STOPP/START Criteria
- Implicit Criteria (judgment based)
  - Highly patient specific and require access to clinical data & highly trained clinician assessors
  - i.e. Medication Appropriateness Index

Beers Criteria

- First developed in 1991 to identify potentially inappropriate medication use in elderly nursing home residents
- Criteria updated and expanded in 1997 to include inappropriate medication use in all patients greater than 65 years of age
- In 2002 and 2012 US Consensus Panel of Experts revised and updated criteria

Arch Intern Med 1997; 157:1531-36
Arch Intern Med 2003; 163:2716-24
J Am Geratr Soc. 2012; 60(4):616-31

Beers Criteria – 2015 Update

- Implement a comprehensive, systematic review with grading of evidence
- Support of the American Geriatrics Society and interdisciplinary panel of experts
- Incorporates new evidence on currently listed potentially inappropriate medications or conditions from the previous 2012 update
- Incorporates 2 new areas of evidence on drug-drug interactions and dose adjustments based on kidney function for selected medications

J Am Geratr Soc. 2015; 63(11):2227-2246

Beers Criteria – 2015 Update

Categories:

- Potentially inappropriate medications and classes to avoid in older adults
- Potentially inappropriate medications and classes to avoid in older adults with certain diseases and syndromes
- Medications to be used with caution in older adults
- Drug-drug interactions that are highly associated with harmful outcomes in older adults
- Potentially inappropriate medications based on kidney function

J Am Geratr Soc. 2015; 63(11):2227-2246

Commonly Used Medications in Beers Criteria

- From clinical practice setting
  - Non-selective alpha blockers
  - Hydroxyzine for sleep
  - Proton Pump Inhibitors
  - Clonidine
  - Promethazine
  - Meclizine
  - Amitriptyline
  - Sliding Scale Insulin
  - NSAIDS
  - Cyclobenzaprine

Multiple Choice Question

The Beers Criteria _____ of medications for the elderly.

a. must be followed by all prescribers

b. should be used as a guideline by prescribers

c. should not be followed by prescribers

Multiple Choice Question

The Beers Criteria _____ of medications for the elderly.

a. must be followed by all prescribers

b. should be used as a guideline by prescribers

c. should not be followed by prescribers

Limitations of Beers Criteria

- Older adults are often underrepresented in drug trials
- Criteria do not address other types of potentially inappropriate medications not unique to aging
  - therapeutic duplication
  - drug-drug interactions
- Criteria do not address palliative and hospice care individuals

J Am Geratr Soc. 2015; 63(11):2227-2246

Limitations of Beers Criteria

- Do not identify all cases of potentially inappropriate prescribing (underuse of drugs in older people)
- Search strategies might have missed studies published in languages other than English and unpublished reports

J Am Geratr Soc. 2015; 63(11):2227-2246
Ann Pharmacother 2010;44:1968-75

STOPP/START Criteria

STOPP = Screening Tool of Older Persons' potentially inappropriate Prescriptions

START = Screening Tool to Alert doctors to the Right Treatment

Update of STOPP/START Criteria

- Changing/expanding evidence since 2008
- New drugs
- More extensive list of potentially inappropriate medications (PIMs)
- Some criteria not completely accurate or relevant or lacking in clinical importance or relevance
- Absence of some criteria
- Seek input from experts across Europe

Age and Ageing 2014;0:1-6

STOPP version 2

- Indication of Medication
  - any duplicate drug class prescription e.g. two concurrent NSAIDs, SSRIs, loop diuretics, ACE inhibitors, anticoagulants
- Cardiovascular System
  - verapamil or diltiazem with NYHA Class III or IV heart failure
  - loop diuretic for dependent ankle edema without clinical, biochemical evidence or radiological evidence of heart failure, liver failure, nephrotic syndrome or renal failure
  - loop diuretic for treatment of hypertension with concurrent urinary incontinence

https://www.farmaka.be/frontend/files/publications/files/liste-start-stopp-version.pdf; accessed 8-23-18

START version 2

- Cardiovascular System
  - 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
- Central Nervous System
  - non-TCA antidepressant drug in the presence of persistent major depressive symptoms

https://www.farmaka.be/frontend/files/publications/files/liste-start-stopp-version.pdf; accessed 8-23-18

Medication Appropriateness Index

MAI Criterion
Are there significant drug-drug interactions?
Are there significant drug-disease interactions?
Is there an indication for the drug?
Is the drug effective for the indication?
Is there unnecessary duplication with other drugs?
Is the duration of therapy acceptable?
Is the dosage correct?
Are the directions correct?
Are the directions practical?
Is this drug the least expensive alternative compared with others of equal utility?

J Clin Epidemiol 1992;45:1045-51

In Summary

Simple	Drug regimen must be as simple as possible Prescribe combination drugs, when possible Aim for once-daily regimens
Adverse	Possible adverse effects of each drug must be understood Avoid drug interactions if possible Avoid drugs with narrow therapeutic windows when possible
Indication	Indication for each drug must be clear Each drug must have a clearly defined therapeutic goal and achieve the desired therapeutic goal
List	The list of drugs in the regimen must be up to date Include in the drug list prescriptions, OTC meds, herbs or alternative meds Ensure that the patient's list corresponds to the physician's list

J Am Board Fam Pract 1998; 11(2): 140-144

Patient Case 1

- BW is an 81 y/o male who comes to the clinic with the complaints of daytime sleepiness, increased difficulties with urination and new onset constipation. BW reports being seen by his Endocrinologist two weeks ago for a f/u of his diabetes and neuropathy
- PMH: HTN, DMT2 with neuropathy, HLP, OA, BPH
- Medications: lisinopril 10mg daily, insulin glargine 30 units at bedtime, gabapentin 300mg at bedtime, simvastatin 20mg at bedtime, aspirin 81mg daily and acetaminophen 500mg/diphenhydramine 25mg 1 tablet at bedtime

Patient Case 1 (continued)

- Which of the following medications is likely to be responsible for BW's newly reported symptoms?

a. Acetaminophen
b. Simvastatin
c. Diphenhydramine
d. Lisinopril

Patient Case 1 (continued)

- Which of the following medications is likely to be responsible for BW's newly reported symptoms?

a. Acetaminophen
b. Simvastatin
c. Diphenhydramine
d. Lisinopril

Patient Case 2

- SM is an 86 y/o male who presents to clinic with his son complaining of left hip pain following a fall at home. Patient lives alone and has fallen a total of three times in the past 6 weeks. The son also complains that his father has decreased memory and was recently started on medication for this condition.
- PMH: HTN, OA, PUD (gastric ulcer 2014), insomnia and allergic rhinitis
- Medications: clonazepam 0.5 mg at bedtime, Zyrtec D 24HR 1 tablet daily, clonidine 0.3 mg tablet at bedtime, hydrochlorothiazide 25 mg every morning, donepezil 10mg at bedtime, 2 OTC ibuprofen tablets three times daily, 1 multivitamin daily

Patient Case 2 (continued)

- Which medication(s) could be potentially inappropriate based upon the Beers' Criteria?
  - a. clonazepam
  - b. clonidine
  - c. ibuprofen
  - d. all of the above

Patient Case 2 (continued)

- Which medication(s) could be potentially inappropriate based upon the Beers' Criteria?
  - a. clonazepam
  - b. clonidine
  - c. ibuprofen
  - **d. all of the above**

Recommended References

- Geriatric Dosing Handbook
  - Semla TP. Geriatric Dosage Handbook, 21st Ed. Lexi-Comp 2015-2016
- American Geriatrics Society
  - http://www.americangeriatrics.org/
- American Society of Consultant Pharmacists
  - http://www.ascp.com/
- Federal Interagency Forum on Aging-Related Statistics
  - https://agingstats.gov/