

# Safe Medication Use in the Older Adult

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# Objectives

- Know the principles of medication use in the elderly
- Identify potentially inappropriate medications for older adults
- Select appropriate medication therapies for older adults through case study examples

# Startling Statistics



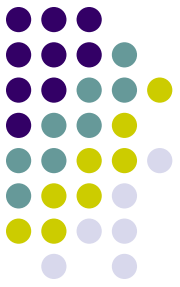
- 10.7% of hospital admissions in older adults are associated with adverse drug reactions (ADRs)
- ADRs cause over 100,000 deaths per year in the United States, making ADRs the fourth leading cause of death in the United States
- Older adults are 2.5 times more likely to visit an emergency room due to an ADR than younger individuals
- Warfarin, insulin, and digoxin together account for over 1/3 of emergency department visits for ADRs among older adults
- About 1 in 3 older persons taking at least 5 medications will experience one adverse drug event each year, and about 2/3 of these patients will require medical attention

# Getting the Whole Picture



- Elderly comprise 13% of population
- Use 25-30% all prescription medications; 25% of nonprescription medications
- 75% of older adults take one or more prescription medications
- 25% of older adults take 5 or more medications on a regular basis
- Use 5.8 Rx drugs concurrently with 3.2 OTC drugs

# What concerns do you have with med use in older adults?



- Changes in aging
  - Drugs affect older adults differently
- Compliance/Adherence
  - Overuse
  - Underuse
  - Unclear medication regimen
- Polypharmacy
  - Treatment of side effect/symptom vs. treatment of disease
- ADRs
  - Attributing adverse effects to normal “aging” or a new illness
  - Underreporting of symptoms
  - Atypical symptoms
- Drug Interactions



# Pharmacokinetics

- Pharmacokinetics
  - How the body affects the drug
    - Management of the drug by the body
  - Absorption, distribution, metabolism, excretion
- NOTE: These changes are not universal. We all age differently. Use as general guidelines.

# Pharmacokinetic Changes

## Absorption



- Changes
  - Decreased surface area and blood flow to GI
  - Decreased GI motility
  - Increased pH
- Result
  - Essentially unchanged
    - May have slightly decreased absorption-little effect
- Drugs affected: ketoconazole, iron supplements (those that require an acidic environment)

# Pharmacokinetic Changes

## Distribution



- Protein binding
  - Decreased albumin with age
    - Binds acidic drugs
    - Institutionalized, malnourished, and sick elderly
    - Results: need lower dose of acidic protein bound drugs
  - Increased  $\alpha_1$ -acid glycoprotein & lipoproteins
    - Increases with inflammation, stress, injury-binds basic drugs
    - Arthritis, institutionalized
    - Results: need higher dose of basic protein bound drugs



# Pharmacokinetic Changes

## Distribution



### *Common Drugs Affected by Albumin*

Digoxin  
Theophylline  
Phenytoin  
Warfarin  
Diazepam

### *Common Drugs Affected by $\alpha_1$ -Acid Glycoprotein/Lipo- proteins*

Propranolol  
Quinidine  
Lidocaine

# Pharmacokinetic Changes

## Distribution



- Volume of Distribution
  - Less total body water
    - Age 20 to 80, decrease 15%
    - Results: need a lower dose for hydrophilic drugs
      - Lower  $V_d$  can result in increased serum concentration
  - Higher fat content
    - Men from 18% to 36%; Women from 33% to 45%
    - Results: need a lower dose for lipophilic drugs
      - Do not use or use cautiously, especially CNS drugs
  - Lower lean muscle mass (decreased muscle)
    - Digoxin binds to muscle; therefore, conc increases as a result of increased  $V_d$  = dig toxicity at doses lower than expected

# Pharmacokinetic Changes

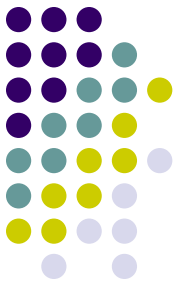
## Distribution



<i>Hydrophilic Drugs</i>	<i>Lipophilic Drugs</i>
Lithium	Phenothiazines
Aminoglycosides	Phenytoin
Ethanol	Diazepam
	Barbiturates
	Propranolol

# Pharmacokinetic Changes

## Metabolism



- Reduced hepatic blood flow
  - Some drugs' rate of metabolism is dependent upon rate of hepatic blood flow
  - Decrease hepatic flow → Reduced amount of drug that is extracted by the liver for metabolism during first pass → Increased bioavailability of that drug
  - Drugs affected: calcium channel blockers, beta blockers, narcotics, nitrates, tricyclic antidepressants, hydralazine, labetalol



# Pharmacokinetic Changes

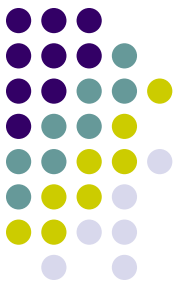
## Metabolism



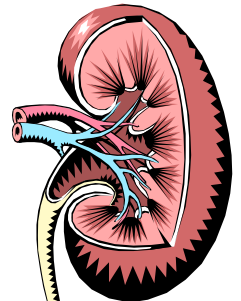
- Reduced hepatic mass and number of functioning hepatocytes
- Phase I and II metabolism performed by cyt P-450 system
  - Decline in Phase I (oxidative) metabolism in elderly
  - Phase II unaffected by aging
  - Major drugs affected: diazepam, alprazolam, chlordiazepoxide, amitriptyline
  - Benaodiazepine Pearl: Use L.O.T.
    - Lorazepam, oxazepam, temazepam

# Pharmacokinetic Changes

## Excretion/Elimination



- Renal function generally decreases with age
- CrCl decreases ~ 10%/decade after age 40 in 2/3 persons
- Pearl: Is serum creatinine a good indicator of renal function in the elderly?
  - NO!
  - Scr is a product of muscle breakdown
    - Decreased muscle mass in aged → reduced production of Scr → could produce normal Scr in person with reduced renal function
  - CrCl is better indicator of renal function



# Pharmacokinetic Changes

## Excretion/Elimination



### *Common Renally-eliminated Drugs*

Allopurinol

Ranitidine, famotadine,  
nizatidine

Ciprofloxacin

Meperidine

Magnesium

Metformin

Aminoglycosides

Most ACE inhibitors (except  
fosinopril)

Digoxin

Lithium

Diuretics



# Compliance/Adherence

- Reasons for noncompliance
  - Lack of understanding
  - Barriers to communications
  - Complex regimen
  - Differing doses
  - Inconvenient scheduling
  - Lack of perceived need
  - Adverse events
  - Cost
  - Social isolation





# Compliance/Adherence

- Discrepancies between medical record and actual medication use
  - 76% had discrepancies
  - 51% taking medications not recorded in chart
  - 29% not taking a recorded medication
  - 20% taking different dosage than recorded

# Polypharmacy

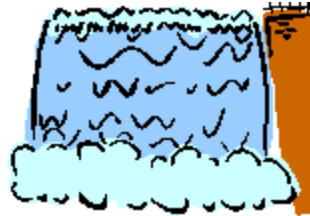


- More chronic medical conditions = more medications
- Patient and prescriber's need to “do something” even for common ailments with no cure
- Doctor shopping-often for the same problem
  - Do not reveal all information at each visit
- Meds prescribed to treat side effects of other meds!
- “Save” or borrow medications; self-medicate

# Prescribing Cascade



Medications prescribed to treat side effects of other medications!!!



“As older patients move through time, often from physician to physician, they are at increasing risk of accumulating layer upon layer of drug therapy, as a reef accumulates layer upon layer of coral.” Jerry Avorn, M.D.



# Adverse Drug Reactions

- Unintended, unwanted, harmful, or unexpected effect of a drug
- 28% of hospitalizations in the elderly attributed to ADRs (17%) and non-adherence (11%)
- 10-35% of elderly outpatients experience ADRs
- May occur in as many as 44% of hospitalized elderly
- ADR risk doubles when drug use increases from 1 to 4 drugs; increases 14-fold in elders who use 7 drugs

*Beers MH, Baran RW, Frenia K. Drugs and the Elderly, Part 1: The Problems Facing Managed Care. The American Journal of Managed Care 2000; 6(12):1313-1320.*

*Col N, et al. Arch Intern Med 1990; 150:841-5.*

*Hanlon JT, et al. JAGS 1997; 45:945-8.*

*Chrischilles EA, et al. Ann Intern Med 1992; 117:634-40.*



# Causes of ADRs

- Improper drug or dosage selection
- Non-adherence to drug regimen
- Altered pharmacokinetics
- Multiple medications
- Multiple providers



# ADR Risk Factors

- Advanced age ( $\geq 85$ )
- Female
- Lower SES
- Lives alone
- Lower body weight
- Hx prior drug reactions
- Regular use of alcohol
- Prior ADR
- Recent hospitalization
- Dementia
- Hepatic or renal insufficiency ( $\text{CrCl} < 50$  ml/min)
- Multiple prescribers
- Long duration of use
- Polypharmacy
- Multiple chronic diseases

# ADR Pearl



Any symptom in an older adult should be considered a drug side effect until proven otherwise!

- Fall
- GI distress
- Incontinence
- Constipation
- Depression
- Anxiety
- Confusion
- Insomnia



# Common ADRs in Elderly

- Falls
  - Sedative/hypnotics, anticonvulsants, antihypertensives, antipsychotics, antineoplastics, hypoglycemics
- GI Distress
  - Aspirin, NSAIDs, iron, theophylline, lipid-lowering agents, antibiotics
- Incontinence
  - Caffeine, diuretics, theophylline, alcohol, sedative/hypnotics



# Common ADRs in the Elderly



- Constipation
  - Verapamil/diltiazem, antipsychotics, antidepressants, narcotics, diuretics, antacids (Al/Ca), anticholinergics
- Confusion
  - Any CNS agent, anti-Parkinson's agents, digoxin, metoclopramide, beta-blockers
- Depression
  - Beta-blockers (propranolol), sedative/hypnotics, hormones, NSAIDs, digoxin, metoclopramide
- Anxiety/insomnia
  - Caffeine, theophylline, SSRIs, decongestants, steroids



# Drug Interactions

- Drug-Drug-too many to list!
  - Common disease states associated with high risk of drug interactions: autoimmune, cardiovascular, gastrointestinal, infection, psychiatric d/o, respiratory, seizure d/o
  - 2 medications = 13% risk
  - 5 medications = 38% risk
  - $\geq 7$  medications = 82% risk
  - Preventable drug interactions account for about 1/3 of ADRs

# Potentially Inappropriate Medications: Beers Criteria



- Beers MH, Ouslander JS, Rollinger J, et al. Explicit criteria for determining potentially inappropriate medication use in nursing home residents. *Arch Intern Med* 1991; 151:1825-32.
- Beers MH. Explicit criteria for determining potentially inappropriate medication use by the elderly. *Arch Intern Med* 1997;157:1531-1536.
- Fick DM, Cooper JW, Wade WE, et al. Updating the Beers criteria for potentially inappropriate medication use in older adults. *Arch Intern Med* 2003; 163:2716-24.

# Potentially Inappropriate Medications: Beers Criteria



- Medications or classes that should generally be avoided in persons 65 years or older because they are either ineffective or they pose unnecessarily high risks for older persons and a safer alternative is available
  - 48 medications or classes to avoid
- Medications that should not be used in older persons known to have specific medical conditions
  - 20 diseases or conditions and medications to avoid

# Potentially Inappropriate Medications: Beers Criteria

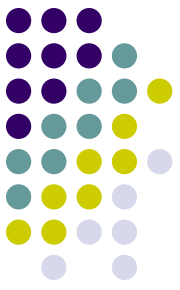


- Propoxyphene
- Indomethacin
- Muscle Relaxants
- Amitriptyline, doxepin
- Meperidine
- Flurazepam
- Anticholinergics & antihistamines
- Chlordiazepoxide, diazepam
- Long acting benzodiazepines
- GI antispasmodics
- Diphenhydramine
- Ticlopidine
- Barbiturates, except for seizures

*Source: Fick DM, et al. Arch Intern Med 2003; 163:2716-24.*

*Beers MH. Explicit Criteria for Determining Potentially Inappropriate Medication Use by the Elderly. Arch Int Med. 1997;157:1531-1536.*

# Potentially Inappropriate Medications Considering Dx: Beers Criteria



- COPD: beta-blockers, sedative/hypnotics
- Ulcers: NSAIDs
- Seizures: metoclopramide, some antipsychotics
- Bladder outflow obstruction: anticholinergics & antihistamines
- Arrhythmias: tricyclic antidepressants
- Insomnia: decongestants, theophylline, SSRIs
- Hypertension: pseudoephedrine
- Cognitive impairment: anticholinergics
- Chronic constipation: calcium channel blockers, anticholinergics, TCA

Source: Fick DM, et al. *Arch Intern Med* 2003; 163:2716-24.

Beers MH. *Explicit Criteria for Determining Potentially Inappropriate Medication Use by the Elderly. Arch Int Med.* 1997;157:1531-1536.

# Potentially Inappropriate Medications: Zhan Criteria



- Zhan C, Sangl J, Bierman AS, et al. Potentially inappropriate medication use in the community-dwelling elderly: findings from the 1996 medical expenditure panel survey. *JAMA* 2001;286:2823-2829.

# Potentially Inappropriate Medications: Zhan Criteria



- Reevaluated Beers criteria with expert panel to evaluate in community-dwelling elderly
- Always avoid: 11 medications
  - Barbiturates, flurazepam, meperidine, etc.
- Rarely appropriate: 8 medications
  - Diazepam, propoxyphene, cyclobenzaprine, etc.
- Some indications: 14 medications
  - Amitriptyline, diphenhydramine, doxepin, etc.

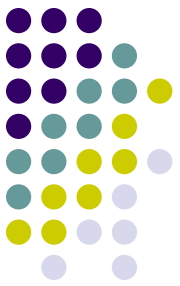


# Outcomes of Inappropriate Prescribing

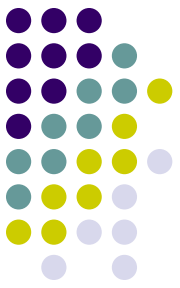


- 3372 nursing home residents with  $\geq 3$  consecutive months of stay
  - 30% higher risk of hospitalization
  - 21% higher risk of death
- 1117 medical records reviewed in 15 nursing homes with high risk of polypharmacy
  - Adverse outcomes: hospitalization, ED visit, or death
  - Any inappropriate prescription increased likelihood of an adverse outcome

# Pearls for Safe Medication Use



- Every drug must have clearly defined indication
- Patient education
- Records containing complete medication review, including OTCs and herbals
- Therapeutic endpoints and ADRs must be monitored
- Provide annual drug regimen review



# *Small Case Study 1*

- MH is a 77-year-old female residing in a NH. Weight=112 lbs. Scr=1.0
- Medications: ranitidine 150 mg bid, atenolol 50 mg qam, diazepam 5 mg qhs, acetaminophen 1g q6h prn pain, MOM 15 ml qid prn



# *Small Case Study 1-Key*

- CrCl = 37.2 ml/min
  - Monitor MOM use
  - Ranitidine: dec. dose to once daily
- Diazepam
  - Not recommended; change to LOT (if needed)
- Pearl: Why do you think she's taking diazepam? Sleep? Heartburn-related?



## *Small Case Study 2*

- CK is a 82-year-old male entering your primary care clinic for an initial visit to establish care. Your interview reveals the following:
  - Tylenol PM qhs, diazepam 2.5 mg qhs, Combivent 2-4 puffs 4 times daily, doxazosin 4 mg qhs
  - Dx: COPD, insomnia, BPH, hypertension
- What meds would you deem potentially inappropriate and why?



## ***Small Case Study 2-Key***

- Tylenol PM has diphenhydramine-not appropriate for elderly or in BPH
- Diazepam-not appropriate for elderly or in COPD



## *Small Case Study 3*

- PT is an 81-year-old female. She enters the clinic pharmacy today after a visit to her primary care provider. She requests some OTC products.
  - Med profile: Triamterene/HCTZ 75/50 mg qd; metoprolol 50 mg bid; glyburide 10 mg bid; insulin 70/30 25 U bid; celecoxib 200 mg qd; propoxyphene-N-100 mg qid
  - OTC list: hard candies, glucose tablets, calcium, Depends, glucosamine, APAP
- What questions should be asked? What are some potential problems?



# *Small Case Study 3-Key*

- MAJOR FALL RISK!
  - Potential hypoglycemia, hypotension, and confusion (propoxyphene)
  - Taking Calcium, so may have OP
- Propoxyphene not recommended in elderly
- Using Depends + diuretic??
- May be having increased pain. . . Did she already have a fall???