Principles of Medication Use in the Elderly

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Learning Objectives

- Key issues in geriatric pharmacology
- Effects of age on pharmacodynamics
- Effects of age on pharmacokinetics
- Risk factors for adverse drug events
- Drug-drug and drug-disease interactions
- Good principles of prescribing

Epidemiology of Aging

- Over 45 million age 65 years and older in U.S. (15% of population)

- Use disproportionate percentage of medications (>33% of prescription drugs)

- >90% of older people take at least 1 drug

- Polypharmacy is common

Prescription Drug Use by Age

Figure 2. Percentage of prescription drugs used in the past month, by age: United States, 2007–2008
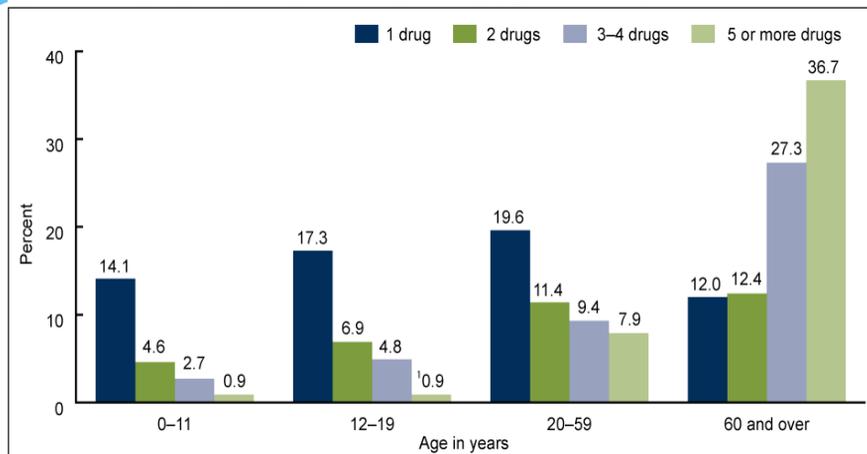
[1] Estimate is unstable; the relative standard error is greater than 30%.
SOURCE: CDC/NCHS, National Health and Nutrition Examination Survey.

Age-Related Issues: Polypharmacy

- Multiple illnesses

- Multiple doctors, lack of communication

- Over-the-counter medications

- Shared medications

- Nutraceuticals common

Consequences of Polypharmacy

- Drug interactions and side effects more common

- Increased risk of geriatric syndromes:
  o Cognitive problems
  o Falls and injuries
  o Incontinence
  o Decline in functional status
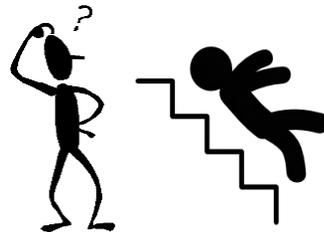
Age-Related Issues: Compliance

- This is an issue with all ages

- Poor compliance is associated with more complicated regimens

- Cost of medications

- Some conditions are asymptomatic

- Good education is important

Medication Compliance

-12%   -12%   -29%

100%   88%   76%   47%

Rx Prescribed   Rx Filled   Rx Taken   Rx Continued *
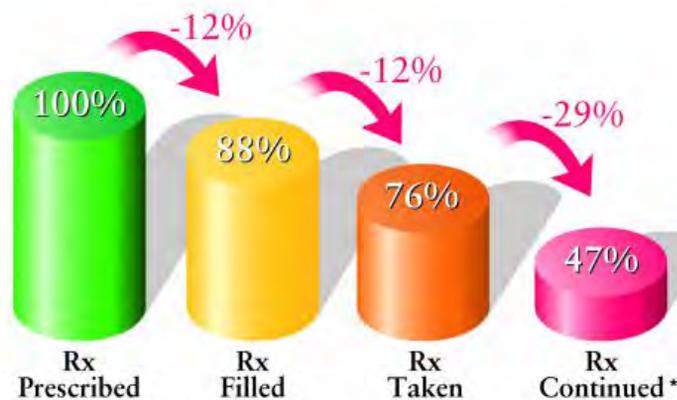
*22% of US patients take less of their medication than is prescribed.

Figure 1. Medication-taking behavior (AHA, 2002).

Age-Related Issues: Specific Problems

- Poor vision – can they read the label?

- Poor hearing – did they hear instructions?

- Memory problems – can they remember?

- Arthritis – can they open the bottle?

- Swallowing problems

- Medical student "Tic-Tac" Exercise

"Tic-Tac" Exercise

Pharmacodynamics

- Definition: What the drug does to the body

- At the same concentration, older people are more sensitive to the effects of drugs

- Changes in the brain with aging:

  o Decrease in neurotransmitters

  o Alteration of blood-brain barrier

  o Neurologic diseases more common

Pharmacokinetics

- Definition: What the body does to a drug

  o Absorption

  o Volume of distribution

  o Protein binding

  o Metabolism

  o Excretion

Aging and Absorption

- Bioavailability (amount absorbed) is usually unchanged, but may be delayed

- GI tract – depends on what is taken with the drug, pH level, motility, GI illness

- Intravenous

- Intramuscular – may be erratic

- Skin, eye

Aging and Volume of Distribution

- Body weight decreases after age 65 (due to decrease in lean body mass)

- Increase in total body fat (higher volume of distribution) → longer duration of action of lipid-soluble drugs

- Decrease in total body water (lower volume of distribution → higher peaks and toxicity of water-soluble drugs (e.g. alcohol)

Aging and Protein Binding

- Proteins in the blood bind to drugs

- Decrease in protein level → higher percentage of unbound (active) drug

- Blood drug levels can be misleading, because they usually measure total levels

- Possible to have toxic effects with normal levels (treat the patient, not the number!)

Aging and Metabolism

- Defined as chemical changes in a drug, most commonly done by the liver

- Aging causes decrease in liver blood flow, size and function

- Some drugs take longer to metabolize

- Co-morbid conditions like congestive heart failure can also affect liver function
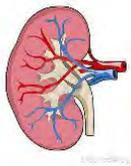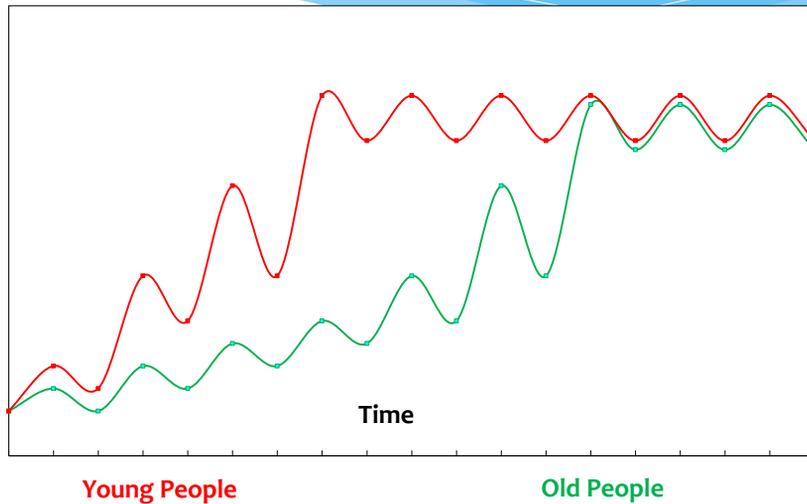
Aging and Excretion

- Most commonly done by the kidney – aging causes decrease in kidney size, blood flow and function

- Kidney diseases more common with age

- Decrease in excretion leads to drug accumulation and toxicity

- Half-life is defined as the time for a drug concentration to decrease by 50%

Half Life of a Drug

Example: Valium (diazepam)
Young adults: ½ life ≈ 24 hours
Older adults: ½ life ≈ 100 hours
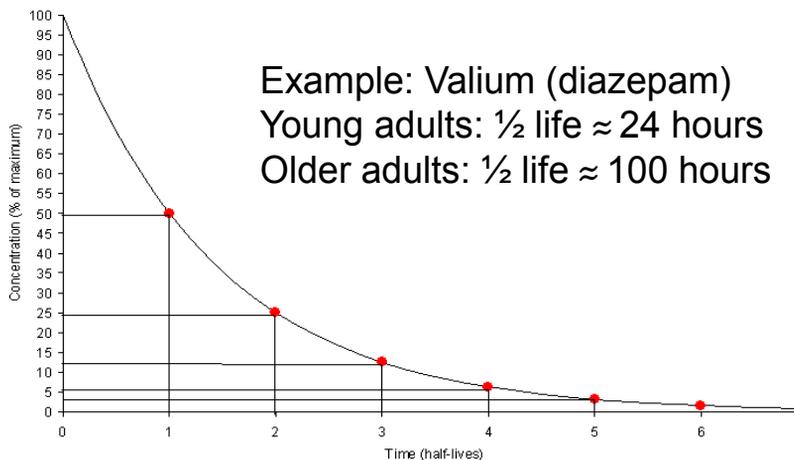
Steady State Drug Levels

Time

Young People   **Old People**

Successful Drug Therapy

- Correct drug

- Correct dosage

- Targets the correct condition

- Appropriate for the patient

- Failure in any of the above can lead to ADE (adverse drug events)

Adverse Drug Events

- Responsible for 700,000 ER visits and 120,000 hospitalizations each year in the U.S.

- $3.5 billion spent each year

- Many ADEs are preventable!
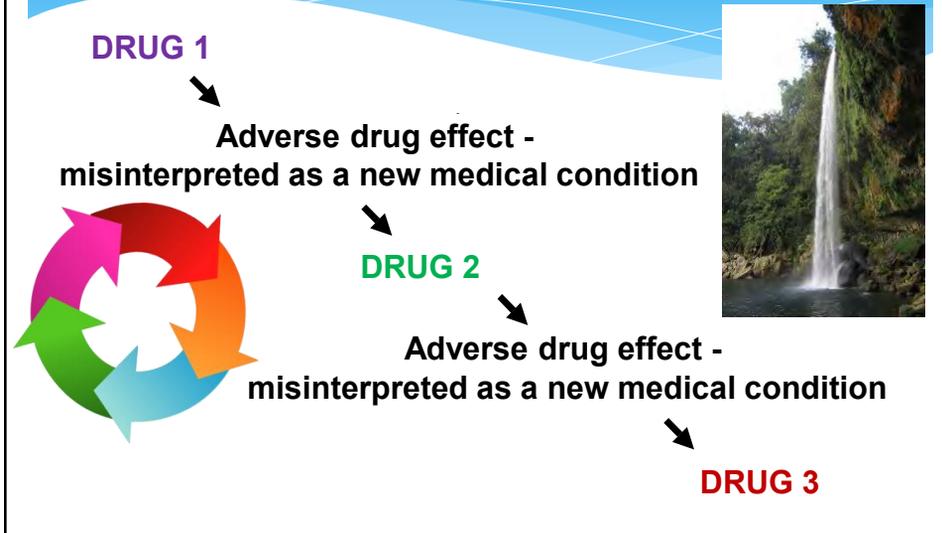
- Elderly patients more prone to ADEs

Risk Factors for ADEs

- Advanced age

- Increased number of drugs (prescription or over-the-counter)

- Prior adverse drug event

- Use of alcohol

- Low body weight

- Poor liver or kidney function

ADE Prescribing Cascade

DRUG 1

**Adverse drug effect -
misinterpreted as a new medical condition**

DRUG 2

**Adverse drug effect -
misinterpreted as a new medical condition**

DRUG 3

Drug-Drug Interactions

- Very common, more likely with higher number of medications

- Can affect absorption or metabolism of other drugs

- Can exaggerate or diminish effects

- Herbal and over-the-counter medications

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Drug-Disease Interactions

- Obesity can alter volume of distribution

- Dementia can increase sensitivity or induce paradoxical reactions to certain drugs (e.g. anticholinergics)

- Liver disease can impair detoxification

- Kidney disease can impair excretion

Beers Criteria

- Originally published in 1991

- Explicit list of Potentially Inappropriate Medications (PIMs) best avoided for older patients (risk > benefit)

- Updated in 1997, 2003

- Since 2011, the American Geriatrics Society undertook to update these on a 3-year cycle

- Updated in 2012, 2015, 2019

Beers Criteria Intent

- Intended for use in adults >65 years, in all settings (ambulatory, acute, institutional), except hospice and palliative care

- Improve medication selection

- Educate clinicians and patients

- Reduce Adverse Drug Events

- Evaluate quality of care, cost and patterns of drug use in older patients

STOPP-START Criteria

- Originally published in 2008, updated in 2015
- Inappropriate Prescribing (IP)
  - Potentially Inappropriate Medications (PIMs)
  - Potential Prescribing Omissions (PPOs)
- Demonstrated to improve medication appropriateness in the hospital and after discharge
- Demonstrated to reduce ADEs and length of stay

Rules for Drug Use in the Elderly

- Start low and go slow

- Assess risk versus benefit

- Don't quit too soon

- Monitor closely for side effects

- Avoid starting 2 drugs at the same time

- Rollercoaster rule
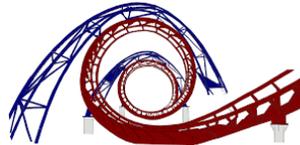
Appropriate Drug Use

- Is the medication necessary?

- What are the goals and end points?

- Do benefits outweigh risks?

- Are you treating effects of another drug?

- Could 1 drug be used for 2 conditions?

- Possible drug or disease interactions?

Good Habits for Doctors

- Does the patient know what each drug is for, how to take it, and possible ADEs? (verbal and written instructions)

- Simplify medication regimen (use mediset)

- Avoid high risk medications

- Each visit (Brown Bag Method) - thorough medication review (include OTCs, herbals, vitamins, eye drops, ointments) - home visits can be very useful

Mediset
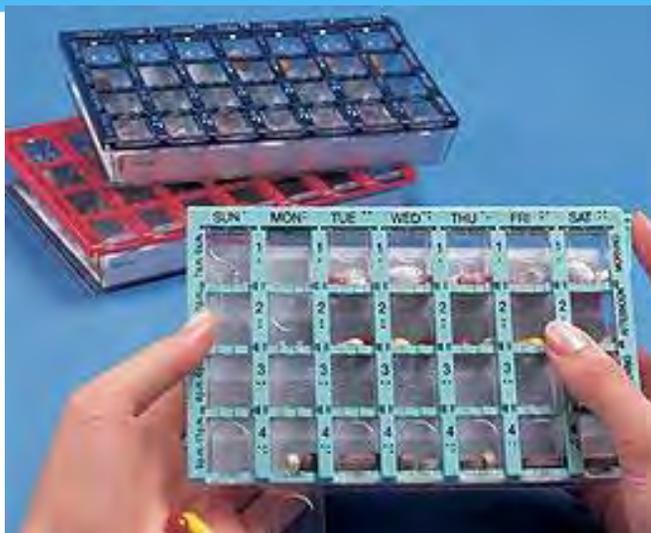
Summary

Successful prescribing means selecting the right drug at the right dose for the right condition and taking into account the individual patient and their goals of care

Thank You!

Questions?