Age-related change, polypharmacy, and medication side effects

Suzanne C. Beyea RN, PhD, FAAN
Director of Nursing Research
Dartmouth-Hitchcock Medical Center
Objectives

- Identify differences between normal aging and pathological conditions
- Describe factors that contribute to polypharmacy
- List potentially inappropriate medications for older adults
- Discuss presentation of an older adult patient with an unfavorable medication side effect
Credit where Credit is Due

• Many of these slides are developed from content available for educational and non-profit use at www.consultgerirn.org.
Overview of age-related change

• Age-associated changes are most pronounced in advanced age of 85 years or older
• May alter the older person’s response to illness & show great variability among individuals
• Often impacted by genetic and long-term lifestyle factors
• Commonly involve a decline in functional reserve with reduced response to stressors
How are age-related changes a problem?

1. Can adversely affect health and functionality
2. Must be differentiated from pathological processes
3. Predispose to disease
4. Can interact reciprocally with illness, resulting in altered disease presentation, response to treatment, and outcomes
Cardiovascular Changes

• *Isolated systolic hypertension*: systolic BP >140 mmHg and diastolic BP <90 mmHg
  – Etiology
    • Arterial wall thickening and stiffening, Left ventricular and atrial hypertrophy, Sclerosis of atrial and mitral valves
Cardiovascular Changes

- Implications of changes
  - Decreased cardiac reserve
  - Inflamed varicosities
  - Risk of arrhythmias, postural and diuretic-induced hypotension
  - Strong arterial pulses, diminished peripheral pulses, cool extremities
Respiratory Changes

• Etiology

1. Decreased respiratory muscle strength; stiffer chest wall with reduced compliance.

2. Diminished ciliary & macrophage activity, drier mucus membranes. Decreased cough reflex.

3. Decreased response to hypoxia and hypercapnia.
Respiratory Changes

• Implications
  – Reduced pulmonary functional reserve
  – Decreased respiratory excursion
  – Decreased cough
  – Increased risk of infection
Renal and Genitourinary Changes

- Etiology

1. Decreases in kidney mass, blood flow, glomerular filtration rate (10% decrement/decade after age 30). Decreased drug clearance.

2. Reduced bladder elasticity, muscle tone, capacity.

3. Increased post-void residual, nocturnal urine production.

4. In males, prostate enlargement with risk of benign prostatic hyperplasia (BPH).
Renal and Genitourinary Changes

• Implications
  – Reduced renal functional reserve
  – Risk of nephrotoxic injury
  – Risk of volume overload, dehydration, hyponatremia, hypernatremia, hyperkalemia, reduced excretion of acid load
  – Increased risk of urinary urgency
Renal and Genitourinary Changes

- Cockroft-Gault Equation: Calculation of creatinine clearance in older adults:

\[
\text{Creatinine clearance (ml/min)} = \frac{(140 - \text{age in years}) \times \text{(body weight in kg)}}{72} \times \text{(serum creatinine, mg/dL)}
\]

- For Women, the calculated value is multiplied by 85% (0.85)
- Should be calculated on all older adults prior to medication administration
Oropharyngeal and GI Changes

- **Etiology**
  - Decreases in strength of muscles of mastication, taste, and thirst perception
  - Decreased gastric motility with delayed emptying. Atrophy of protective mucosa
  - Malabsorption of carbohydrates, vitamins B12 and D, folic acid, calcium
  - Impaired sensation to defecate
  - Reduced hepatic reserve → Decreased metabolism of drugs
Oropharyngeal and GI Changes

- Implications
  - Risk of chewing impairment, fluid/electrolyte imbalances, poor nutrition
  - Gastric changes
  - Risk of adverse drug reactions
Musculoskeletal Changes

- **Sarcopenia**: Decline in muscle mass and strength associated with aging
  - Etiology
    - weakness and poor exercise tolerance
    - Lean body mass replaced by fat with redistribution of fat
    - Bone loss in women and men after peak mass at 30 to 35 years
    - Change in ligament, tendons, and spine
Musculoskeletal Changes

• Implications
  – increased risk of disability, falls, unstable gait
  – Risk of osteopenia and osteoporosis
  – Limited ROM, joint instability, risk of osteoarthritis
Neurological Changes

- Etiology
  - Decrease in neurons and neurotransmitters
  - Modifications in cerebral dendrites, glial support cells, synapses
  - Compromised thermoregulation
Neurological Changes

• Implications
  – Impairments in general muscle strength; deep-tendon reflexes; nerve conduction velocity
  – Decreased temperature sensitivity
  – Slowed speed of cognitive processing
  – Increased risk of sleep disorders, delirium, neurodegenerative diseases
10 Warning Signs of Alzheimer’s

- Memory Loss
- Difficulty performing familiar task
- Problems with language
- Disorientation to time and place
- Poor of decreased judgment
- Problems with abstract thinking
10 Warning signs of Alzheimer’s

• Misplacing things
• Changes in mood or behavior
• Changes in personality
• Loss of initiative
A few questions

• Is it a normal part of aging to become incontinent of urine or stool?

• Is it a normal part of aging for someone to increase their adipose tissue while decreasing lean muscle?

• Is it a normal part of aging for someone to forget how to get home from a familiar location?
• Mr. Jones has all of the normal age-related change a 83-year-old widowed male could expect. Additionally, he has hypertension, heart failure (EF 30%), hypercholesteremia, depression, and osteoarthritis of the knees. He medications include lisinopril 40mg qd, carvedilol 6.25mg b.i.d., furosemide 40mg qd, citalopram 20mg qd, and acetaminophen 500mg t.i.d. and an OTC MVI.
Mr. Jones presents to your ED from a local assisted living facility with a chief complaint of difficulty breathing. He is brought in by his daughter who noticed her Dad was struggling to talk on the phone. You obtain his history as noted before, and learn additionally that Mr. Jones has put on 10 pounds over the last month, and has swollen extremities.

- What is going on here?
- How do you think he got here / what other questions would you ask?
Medications and the Elderly
Prescriptions & Older Adults

- Older adults get 2-3 times as many prescriptions
  - 12% of population > 32% of prescription drugs
  - Avg - $955 per year on drugs
- Typical older adult takes 4-5 prescriptions and 2 OTC drugs at once

- Why?
  - More acute & chronic disease
  - More doctors visits
    - Fragmented with specialist care
  - More trips to ED
  - More side effects to medications
    - Drugs often given to counteract a side affect of another drug
Polypharmacy – “Many Drugs”

Why does it happen
In 2000, older adults made 200 million visits to healthcare providers
1/3 visits – no drug prescribed
1/3 visits – 1-2 drugs prescribed
1/3 visits – 3+ drugs prescribed
In the US, estimates of as many as 200,000 people may die of medication-related problems or adverse drug reactions (ADR) each year. Simonson et al. Medication Related Problems in the elderly, *Drugs & Aging*, 2005.

- Risk of clinically serious ADR is 4 per 100 prescriptions, 1 in 1000 will die.
- Prescription drugs 80% of ADR, OTC 20% of ADR
- Estimates of 5-17% of hospital admissions are related to ADR

“If adverse drug effects were classified as a distinct disease, it would rank as the fifth leading cause of death in the US.” Lasorou et al. Incidence of adverse drug reactions in hospitalized patients: a meta-analysis of prospective studies. *JAMA*, 1998.

Healthcare Provider Factors that Contribute to Polypharmacy

- No med review with patient on regular basis
- Presumes that patient expects meds
- Prescribes without sufficiently investigating clinical situation
- Evidence that a particular drug is the “best” drug for a problem
  - Complicated by the existence of many problems and multiple providers
- Provides unclear, complex or incomplete instructions about how to take meds
- No effort to simplify medication regimen
- Ordering automatic refills
- Lack of knowledge of geriatric clinical pharmacology
- Fear of accusations of ageism or cultural bias
Patient Factors that contribute to Polypharamacy

- Seeing multiple providers and using multiple pharmacies
- Hoarding meds & insisting on taking meds that no longer maybe appropriate
- Do not accurately report meds taken or symptoms, can result in duplicate meds
- Assume that once medication started it should be continued
- Changes in activities, smoking, food and fluid intake can affect action of meds.
Pharmacokinetic features

- Extension of half-life
- Change in volume of distribution of medication depending on whether it is lipid or water soluble
- Bound to proteins > lower albumin may permit more free drug to pass the blood-brain barrier

- Therapeutic Index – effective level to toxic level
- Metabolism in elderly
  - Phase I – less active metabolites are formed
  - Phase II – transformation to inactive metabolites remains stable
Pharmacodynamic features

- Drugs can interact pharmacodynamically to increase the adverse effects to the point of toxicity and delirium.
- Must evaluate total anticholinergic or dopaminergic burden of the patient’s drug regimen.
- In elders, cholinergic receptors more sensitive so exaggerate adverse effects.
- With aging there is change in receptor function across organs & organ systems.
- Net effect is heightened sensitivity of the brain to adverse effects.
- There is also interaction between drug and disease such as Parkinson’s & dopamine and Alzheimer’s & acetylcholine.
The Results

• Age related change + multiple medications + numerous drug / drug interactions + food / drug interactions + use of herbal and OTC remedies + Pharmacokinetic/dynamic changes = INCREDIBLY HIGH ADVERSE DRUG EVENT RATE.
Medication-Related Problem (MRP)

- Defined by Hepler & Strand
  - “an event or circumstance involving a patient’s drug treatment that actually, or potentially, interferes with optimal outcome.”
  - Eight categories of MRP
    - Medical condition requires new or additional medication
    - Patient taking unnecessary drug given present condition
    - Wrong drug for patient’s medical condition
    - Correct drug, dose too low
    - Correct drug, dose too high
    - Adverse drug reaction
    - Drug interaction
    - Patient not taking drug correctly
Drug Reactions Look Like Growing Old

- Unsteadiness
- Dizziness
- Confusion
- Nervousness
- Fatigue

- Insomnia
- Drowsiness
- Falls
- Depression
- Incontinence

But is 5th leading cause of death in older adults
Recognition of Drug-Induced Reactions

• Initial step:
  – Review the medications
  – Examine temporal relationships between new meds or increased/decreased dosage or discontinuation and onset of symptoms
  – Hyperactive state – suspect cholinergic toxicity, alcohol intoxication, stimulant intoxication, serotonin syndrome, alcohol or benzodiazepine withdrawal
  – Hypoactive state – suspect sedative or narcotic intoxication, alcohol or benzodiazepine intoxication
Emergency

• Medications – Assess
  – Ask:
    • Are you taking any medications, and do you know how to take them
    • For a list of medications (including herbals)
    • Assess understanding of and compliance with medications regiment

  – Determine if there are any problems with medications or allergies to medications.

Harvard Pilgrim Health Care Geriatric Screening Assessment - 1998
• Medications Cont.
  – Beers’ Criteria for Potentially Inappropriate Medication Use in Elderly
    • See *Try This* handout
  – ACUTE CHANGE IN MS a mnemonic to remember medications that can cause acute MS changes
  – Common prescription errors
    • Polypharmacy
    • No adjustment for renal function
Beers’ Criteria for Potentially Inappropriate Medication Use in the Elderly

By Sheila L. Mahony MS, APRN

RECENTLY, published studies confirm that inappropriate medication use remains a serious problem for the elderly. Increased nursing awareness of high-risk medications enables attentive monitoring for adverse effects and facilitates collaborative efforts between nurses, primary care providers and pharmacists to reduce medication-related risk.

BEST PRACTICE: The adapted Beers’ Criteria (GERIA) Guidelines for Potentially Inappropriate Medications in the Elderly identifies medications noted by an expert panel to have potential risks that outweigh potential benefits of the drug. The criteria are appropriate for persons older than 50 years of age, regardless of their level of frailty. The criteria provide a rating of severity for adverse outcomes (severe vs. less severe) as well as a desirable summary of the prescribing concerns associated with the medication.

VALIDITY AND RELIABILITY: The criteria were developed using a modified Delphi method to achieve consensus among 8 nationally recognized experts in geriatric care and pharmacology. The criteria have been used alone and in combination with settingspecific criteria to screen populations for possible medication-related problems. Further research is needed to validate the occurrence and severity of negative outcomes associated with high-risk medications.

STRENGTHS AND LIMITATIONS: The criteria do not identify all cases of potentially inappropriate prescribing and they may sometimes identify appropriate prescribing as inappropriate. The criteria are designed for population-based screening and are not intended to substitute for professional judgment regarding the individual needs of particular older adults.

FOLLOW-UP: Nurses may use the criteria to increase awareness of medications that may present increased risk for adverse drug reactions. Nurses, primary care providers and pharmacists may collaborate to optimize individualized prescribing practices, develop monitoring and intervention. The suggested references provide further information on high-risk medications specific to patient diagnosis and prescribing practices in specific care settings.

MORE ON THE TOPIC:


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Drug Therapy with *Severe Adverse Outcome* Potential:

– Amitriptyline

– Barbituates (all except phenobarbital)

– Long-acting benzodiazepines
Beers’ Criteria

**Severe Outcome** Potential cont:

– Chlorpropamide

– Dicyclomine

– Digoxin
Severe Outcome Potential cont:

– Disopyramide

– Doxepin

– Meperidine
Beers’ Criteria

**Severe Outcome** Potential Cont:

– Meprobamate

– Aldomet (Methyldopa)

– Pentazocine

– Ticlopline
Beers’ Criteria

Drug Therapy with High Potential for Less Severe Reactions:

– Diphenhydramine

– Dipyridamole

– Ergot mesyloids
Beers’ Criteria

**Less Severe** Outcome Potential:
- Antihistamines (single and combination)
- Indomethacin
- Methocarbamol
Less Severe Outcome Potential:

– Reserpine

– Trimthobenzamide
Emergency

• Nursing Care and Intervention
  – Organize teaching to maximize patient understanding
  – Collaborate with MD to simplify regiment PRN
  – Encourage patient to have prescriptions filled at same pharmacy
  – Introduce assistance aids to patient and family
  – Assist patient with modifying self-medication practices, particularly the risk with alcohol.
• Medication Evaluation
  – Did it work?
    • Patient will:
      – Experience fewer iatrogenic outcomes from medications.
      – Understand their medication regimens.
    • Healthcare Providers Will:
      – Use of a range of interventions to prevent, alleviate, or ameliorate medication problems with older adults.
      – Document on-going comprehensive medication assessment.
      – Increased their knowledge about medication safety in the elderly.
      – Increase referrals to appropriate practitioners
In Summary
Polypharmacy leads to:

- Adverse drug reactions (ADR) – 10-20% of those admitted to medical services due to OTC meds
  - # of drugs is single greatest risk for ADR
- Drug-drug reactions
- Decreased medication compliance
- Poor quality of life
- Unnecessary drug expense
DHMC Night