

Overmedication: A Hazard for Elders (219)

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Contact hours: 2

Course price: \$19

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Course Summary

Outlines the serious and often life-threatening problem of polypharmacy in elders, including the increased risk for falls. Pharmacodynamics are explained in context of the geriatric population. Beers criteria, used to identify inappropriate medications for older adults, is introduced. Includes measures to improve medication management and to enhance compliance.

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Criteria for Successful Completions

80% or higher on the post test, a completed evaluation form, and payment where required. No partial credit will be awarded.

Course Objectives

When you finish this course you will be able to:

- ◆ Identify three problems associated with polypharmacy in elders. Summarize three risks associated with multiple medications.
- ◆ Describe five physiologic changes of aging that impact the efficacy of medications. Distinguish between pharmacokinetics and pharmacodynamics.
- ◆ Explain the overall purpose of the Beers criteria.
- ◆ Describe two additional screening strategies for identifying inappropriate medications for older adults.
- ◆ Identify five adverse results of polypharmacy.
- ◆ Relate three ways in which polypharmacy can increase the risk of falls in older adults. List five ways to improve medication management for elders.

The Challenges of Polypharmacy

Leona, a 78-year-old female, didn't sound like herself on the phone while chatting with her son. She and her husband lived alone after raising their four children. They enjoyed their retirement years, generally sitting at home watching TV and sewing or reading.

Leona had many health problems, including chronic bronchitis, diabetes, visual problems, neuropathy, hypertension, hypothyroidism, and depression, and was on medications for each. In addition, she was taking over-the-counter vitamin supplements and herbal remedies that a friend had told her about, which summed to over 12 medications daily. As Leona's vision worsened, so did her memory of which medications she had already taken from all of the bottles in her medicine cabinet.

Now, her son noticed her speech was slurred, she couldn't keep up with the conversation, and was repeating herself. After work, he drove to her home only to find his mother more confused and his father unsure what to do for her. He took her to the hospital ED.

Hours later, and after multiple tests, it was determined she had taken too many medications over the past week, which had induced delirium.

The concurrent use of multiple drugs, especially in elders, is a serious and often fatal issue. Unfortunately, the scenario above is all too common in the United States, especially in our geriatric population.

Polypharmacy describes the use of multiple medications at one time, including over-the-counter (OTC) medications, dietary supplements, and herbal remedies. *Polypharmacy* includes prescribing more medication than is clinically indicated, using inappropriate medications, and using the correct medication for an inappropriate length of time (Lococo & Staplin, 2006; Patterson, 2012).

Research shows polypharmacy of five or more drugs creates potential **adverse drug reactions (ADRs)**, also called *adverse drug effects*, as the medications interact with each other and often increase complications from comorbidities of diseases the medications are designed to treat (Gomez et al, 2015; Lai, 2010).

In addition to the increased risk of ADRs, other complications include *medical illiteracy*, which may lead to nonadherence to the treatment regimen and prescription instructions; this is exacerbated by the likelihood that each medication may have a different schedule.

Polypharmacy Hazard



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Medication management is a challenge for the older adult due to decreasing vision and dexterity, concomitant diseases, multiple caregivers and physicians, financial ability to pay for medications, nonadherence, declining metabolism, and often memory decline. More than 90% of those 65 or older use at least one medication per week, 40% take five or more, and 12% use ten or more (Qato et al., 2008). Medication errors cause 10% to 30% of all hospitalizations annually in older patients (Parameswaran et al., 2016).

Not only does polypharmacy create preventable healthcare costs, but it also significantly increases morbidity and mortality. It is estimated that almost one-third of older home health care patients are taking a medication that is considered inappropriate for older people (ANA, 2015). Inappropriate prescribing is common in older patients, as there may be multiple providers recommending differing interventions, and the prescriber's information regarding current medications is based on patient report, which may or may not be reliable. It is estimated that nearly half of older adults are taking one or more medications that are not clinically necessary (Maher et al., 2014).

Test Your Learning

The term *polypharmacy* describes:

- A. Medications that are synthetic rather than biological.
- B. Use of multiple medications at one time.
- C. Buying prescription drugs at more than one pharmacy.
- D. Getting prescriptions from more than one physician.

Answer: B

Home medication management systems range from the careful and methodical to the random and arbitrary. Elders who have difficulty opening medication bottles may utilize the “candy dish” method—dumping multiple medications into one bowl and fishing out the appropriate medication at the scheduled time (see image above). Some older adults store medications in shopping bags or shoeboxes, while others carefully fill medication dividers weeks in advance. As the number of older adults increase, health professionals need to spend more time evaluating medication regimens.

The rate of growth in the number and proportion of older adults is unprecedented in the history of the United States. Two factors—longer life spans and the large cohort of aging baby boomers—will combine to double the population aged 65 and older in the next twenty-five years. By 2050 the population of age 65 and older is estimated to double to 83.7 million compared to the 43.1 million in just 2012 (CDC, 2014). Globally the proportion of elders is 8.5% and is projected to rise to 236 million people aged 65 and older (CDC, 2016a). Proper use of medications is critical to proper and cost-effective chronic disease management.

Did You Know. . .

In the United States, 3% to 7% of all hospitalizations are for treatment of adverse drug reactions.

Improved medical care and prevention efforts have contributed to dramatic increases in life expectancy in the United States over the past century. These factors have caused a major shift in the leading causes of death, from infectious diseases and acute illnesses to chronic diseases and degenerative illnesses. The incidence of

chronic disease increases with advancing age, causing Medicare expenditures to rise proportionally. Currently, about 92% of older Americans are living with at least one chronic condition and 77% suffer from at least two (NCOA, 2016). Elders who have developed multiple chronic diseases will therefore be at greater risk of being prescribed additional medicine as part of the treatment approach.

The cost of providing healthcare for an older American is 3 to 5 times greater than the cost for someone younger than 65. By 2030 the nation's healthcare spending is projected to increase by 33% (Neuman et al., 2015). A large proportion of medical expenditure is attributable to medication-related problems, which cost the United States 200,000 lives and \$21 billion a year (Andel, 2012). Elders are at risk because of their high rate of medication use. Strategies—including pharmaceutical care managed by clinical pharmacists, prescriber education programs, and others—are effective in a study setting but resource-intensive to implement in the population.

Pharmacodynamics refers to the effect that the drug has on the body, whereas, **pharmacokinetics** is the way the drug moves through the body of a person and includes the separate processes of ingestion, absorption, distribution, metabolism and excretion (Wynne et al., 2011). Age-related changes in physiology can render an older adult more sensitive to medications, making polypharmacy a major issue associated with adverse drug events (ADEs), increased hospitalizations, and a wasteful use of increasingly scarce resources. In elders, intestinal absorption slows, and kidneys and liver's ability to metabolize drugs effectively in the first pass make drugs potentially more toxic in the body.

Polypharmacy significantly increases the chance for medication non-adherence, medication errors, and drug-drug, drug-food, and drug-disease interactions. The risk for ADRs increases as the number of medications increases. The older adult who has cognitive impairment, who is living alone, or who is seeing multiple prescribers, is especially at risk. As noted above, normal changes of aging alter the effects of medications, so that medications appropriate for younger people may be contraindicated in older adults due to lower muscle mass, slower renal clearance, and intestinal absorption.

Test Your Learning

2. Risk for adverse drug reactions (ADRs):
- A. Decreases with age and experience.
 - B. Increases in women of childbearing age.
 - C. Decreases in those who consult multiple specialists.
 - D. Increases as the number of medications increases.

Answer: D

Elders make up 18% of the American population but receive 34% of all prescriptions and consume 40% of all nonprescription medications (Garcia, 2006). The average person over the age of 65 takes twice as many medications as the average younger person. These include prescription medications, recreational drugs, over-the-counter (OTC) medications, or herbal remedies.

In the United States, nearly 30% of all hospital admissions are older adults who have not taken their medications properly. The classes of drugs most commonly associated with ADRs in older adults include diuretics, warfarin, nonsteroidal anti-inflammatory drugs (NSAIDs), selective serotonin reuptake inhibitors (SSRIs), beta blockers, and angiotensin-converting enzyme inhibitors (ACEI) (Cresswell, 2007).

In a 12-month cohort study of nearly 28,000 Medicare+Choice enrollees cared for in an ambulatory clinic in 1999–2000, researchers found that 75% of the participants received prescriptions for six or more prescription drugs. The list that follows presents specific prescription medication categories and percentages of enrollees receiving prescriptions (Lococo & Staplin, 2006).

Common Drug Classes Taken in Medicare Patients

Cardiovascular (53.2%)	Thyroid (9.4%)
Antibiotics/anti-infectives (44.5%)	Antihistamines (9.2%)
Diuretics (29.5%)	Hormones (9.1%)
Opioids (21.9%)	Anticoagulants (7.0%)
Anti-hyperlipidemics (21.7%)	Muscle relaxants (5.4%)
Nonopioid analgesics (19.8%)	Osteoporotics (5.3%)
Gastrointestinal tract (19.0%)	Anti-seizure (3.4%)
Respiratory tract (15.6%)	Anti-gout (3.2%)
Dermatologic (14.8%)	Anti-neoplastics (2.8%)
Antidepressants (13.2%)	Anti-platelets (1.3%)
Sedatives/hypnotics (12.9%)	Anti-psychotics (1.2%)
Nutrients/supplements (12.3%)	Anti-parkinsonians (0.9%)
Hypoglycemics (11.5%)	Alzheimer disease (0.9%)
Steroids (9.7%)	Immunomodulators (0.04%)
Ophthalmics (9.6%)	

Test Your Knowledge

In a 12-month study of the scope of polypharmacy, three-quarters of the participant elders were taking six or more prescribed drugs.

- A. True
- B. False

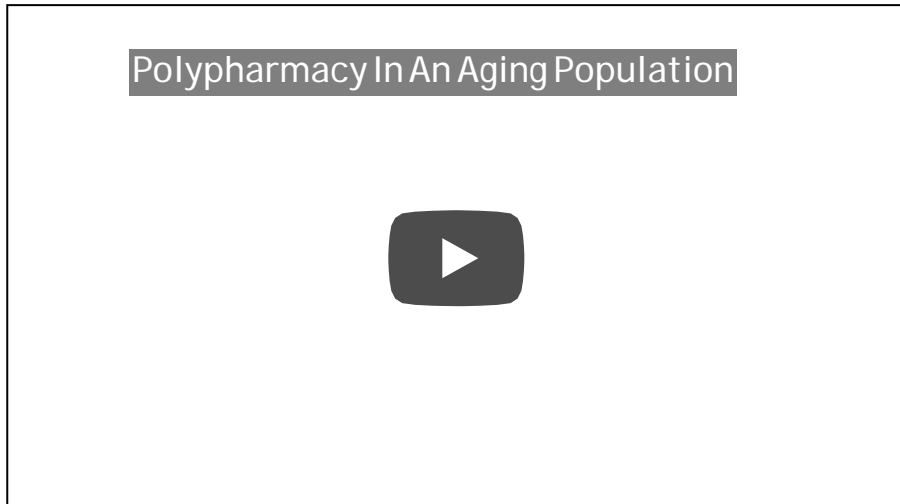
Apply Your Knowledge

Q: What could have been done for Leona in our case scenario to avoid the overdose of polypharmacy and resultant hospitalization?

A: If you as the healthcare professional interacted with Leona, it would be helpful to ask for a list of her medications and what she knows about each one, including the over the counter (OTC) medications. Patients should be encouraged to know about all their medications—what they're for and what adverse effects to watch for. For elders, a written list is helpful and can be created as easily as writing them on a note card for the patient to keep in their wallet or purse. Medic-Alert style bracelets should be encouraged, especially for diabetics.

Online Resource

Video (2:58) Polypharmacy in an Aging Population



https://www.youtube.com/watch?v=f0DaJhQDQ_Y

Screening Strategies

Leona was admitted to the hospital to monitor her for adverse drug effects and medication adjustments. Her preventable hospital bill came to over \$5800 for a two-day hospital stay. In collaboration with the emergency physician, hospitalist and nurses, a medication reconciliation was completed and several medications were discontinued.

She was discharged with instructions to follow up with her primary care physician. At the followup, the PCP realized that the patient had been taking medications of which he was unaware that had been prescribed by other doctors including her endocrinologist. To sum, the patient had been taking medications from various doctors and each physician was unaware of the others. Leona didn't understand what each medication did, and she defended herself by saying "My doctor knows all about that."

Beers Criteria

In 1991 Geriatrician Mark Beers and colleagues published an expert consensus document to establish criteria for identifying medications that are inappropriate for use in older adults. The **Beers criteria** is used to identify "potentially inappropriate medications" for older adults, meaning the risk may outweigh the benefit. More commonly known as "Beers List," it is a set of guidelines, updated in 2015, for healthcare professionals to improve the safety of prescription medications for older adults (AGS, 2015). Research has shown that 21.3% of older Americans received at least one potentially inappropriate drug and 2.6% received an "always avoid" drug (Budnitz et al., 2011).

Test Your Knowledge

The Beers criteria are designed to identify:

- A. Medications inappropriate for use in older adults.
- B. Practitioners who write too many prescriptions.
- C. Caregivers who need education in giving medications properly.
- D. Medications with side effects known to be potentially dangerous.

Answer: A

The American Geriatric Society refined the Beers list in 2015 of medications by identifying drugs that should:

- Always be avoided (have serious potential effects and alternative medications are available)
- Are rarely appropriate
- Have indications for use in older patients but are frequently misused (AGS, 2015)
- An example of polypharmacy as a worldwide challenge was a study in seventeen Japanese long-term care facilities who used the Beers criteria to assess the prevalence of inappropriate medication use. It concluded that the use of inappropriate medications was similar in Japan to that of other countries. The study noted that the highest prevalence of “inappropriate medication use dependent on the disease or condition” was found in patients with chronic constipation, who were treated with medications such as calcium channel blockers, anticholinergics, and tricyclic antidepressants (Niwata, 2006). The researchers also noted 21.1% of the patients were treated with potentially inappropriate medication independent of disease or condition and 18% of patients were treated with at least one inappropriate medication dependent on the disease or condition (Niwata, 2006).

A number of other studies have identified common medication culprits, including diphenhydramine, amitriptyline, and co-administered warfarin and nonsteroidal anti-inflammatory medications (NSAIDs). Propoxyphene (Darvon), a mild pain reliever that had been on the list, was officially banned from use in November 2010 after the Food and Drug Administration (FDA) acknowledged that there were excess cardiac events, including fatal arrhythmias, associated with use of the medication (FDA, 2010). Clinicians and healthcare providers must stay alert to assess for ADRs and report them to the FDA.

Additional studies implicated pain relievers, benzodiazepines, antidepressants, and musculoskeletal agents as the cause of 61% of the incidents of inappropriate prescribing. The 2015 Beers criteria also updated the list of drugs to avoid as those having classic drug- drug interactions such as alpha-1 blockers used in combination with loop diuretics, which increases urinary incontinence, and the use of three or more central nervous system (CNS)-active drugs should be avoided as they increases the risk for falls (AGA, 2015a). Of particular note is that 66 drugs were considered by the panel to have the potential for severe adverse outcomes when used in older adults.

We are able to reproduce the 2012 Beers Criteria here; it was taken from the [printable card found here](#).

TABLE 1: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults

Organ System, Therapeutic Category/Drug(s)

Recommendation, Rationale, Quality of Evidence (QE) & Strength of Recommendation (SR)

Anticholinergics (excludes TCAs)

First-generation antihistamines (as single agent or as part of combination products)

- Brompheniramine
- Carbinoxamine
- Chlorpheniramine
- Clemastine Cyproheptadine
- Dexbrompheniramine
- Dexchlorpheniramine
- Diphenhydramine (oral)
- Doxylamine Hydroxyzine
- Meclizine Promethazine
- Triprolidine

■ Antiparkinson agents

- Benztropine (oral)
- Trihexyphenidyl

Avoid.

Highly anticholinergic; clearance reduced with advanced age, and tolerance develops when used as hypnotic; increased risk of confusion, dry mouth, constipation, and other anticholinergic effects/toxicity.

Use of diphenhydramine in special situations such as acute treatment of severe allergic reaction may be appropriate.

QE=High (Hydroxyzine and Promethazine), Moderate (All others); SR=Strong

Avoid.

Not recommended for prevention of extrapyramidal symptoms with antipsychotics; more effective agents available for treatment of Parkinson disease.

QE=Moderate, SR=Strong

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Antispasmodics Belladonna

- alkaloids
- Clidinium-chlordiazepoxide
- Dicyclomine
- Hyoscyamine
- Propantheline
- Scopolamine

Avoid except in short-term palliative care to decrease oral secretions.

Highly anticholinergic, uncertain effectiveness.

QE=Moderate, SR=Strong

Antithrombotics

Dipyridamole, oral short-acting*
(does not apply to the extended-release combination with aspirin)

Avoid.

May cause orthostatic hypotension; more effective alternatives available; IV form acceptable for use in cardiac stress testing.

QE=Moderate, SR=Strong

Ticlopidine*

Avoid.

Safer, effective alternatives available.

QE=Moderate, SR=Strong

Anti-infective

Nitrofurantoin

Avoid for long-term suppression; avoid in patients with CrCl <60 mL/min.

Potential for pulmonary toxicity; safer alternatives available; lack of efficacy in patients with CrCl <60 mL/min due to inadequate drug concentration in the urine.

QE=Moderate, SR=Strong

Cardiovascular

TABLE 1: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults

Alpha₁ blockers

- Doxazosin
- Prazosin
- Terazosin

Avoid use as an antihypertensive.

High risk of orthostatic hypotension; not recommended as routine treatment for hypertension; alternative agents have superior risk/benefit profile.

QE=Moderate, SR=Strong

Alpha agonists

- Clonidine
- Guanabenz*
- Guanfacine*
- Methyldopa*
- Reserpine (>0.1 mg/day)*

Avoid clonidine as a first-line antihypertensive. Avoid others as listed.

High risk of adverse CNS effects; may cause bradycardia and orthostatic hypotension; not recommended as routine treatment for hypertension.

QE=Low, SR=Strong

Antiarrhythmic drugs (Class Ia, Ic, III)

- Amiodarone
- Dofetilide
- Dronedarone
- Flecainide
- Ibutilide
- Procainamide
- Propafenone
- Quinidine Sotalol
-

Avoid antiarrhythmic drugs as first-line treatment of atrial fibrillation.

Data suggest that rate control yields better balance of benefits and harms than rhythm control for most older adults.

Amiodarone is associated with multiple toxicities, including thyroid disease, pulmonary disorders, and QT interval prolongation.

QE=High, SR=Strong

Disopyramide*

-

Avoid.

Disopyramide is a potent negative inotrope and therefore may induce heart failure in older adults; strongly anticholinergic; other antiarrhythmic drugs preferred.

QE=Low, SR=Strong

TABLE 1: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults

Dronedarone

Avoid in patients with permanent atrial fibrillation or heart failure.

Worse outcomes have been reported in patients taking dronedarone who have permanent atrial fibrillation or heart failure. In general, rate control is preferred over rhythm control for atrial fibrillation.

QE=Moderate, SR=Strong

Digoxin >0.125 mg/day

Avoid.

In heart failure, higher dosages associated with no additional benefit and may increase risk of toxicity; decreased renal clearance may increase risk of toxicity.

QE=Moderate, SR=Strong

Nifedipine, immediate release*

Avoid.

Potential for hypotension; risk of precipitating myocardial ischemia.

QE=High; S =Strong

Spirolactone >25 mg/day

Avoid in patients with heart failure or with a CrCl <30 mL/min.

In heart failure, the risk of hyperkalemia is higher in older adults if taking >25 mg/day.

QE=Moderate; SR=Strong

Central Nervous System

TABLE 1: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults

Tertiary TCAs, alone or in combination:

- Amitriptyline
- Chlordiazepoxide-amitriptyline
- Clomipramine
- Doxepin >6 mg/day
- Imipramine
- Perphenazine-amitriptyline
- Trimipramine

Avoid.

Highly anticholinergic, sedating, and cause orthostatic hypotension; the safety profile of low-dose doxepin (≤ 6 mg/day) is comparable to that of placebo.

QE=High; SR=Strong

Antipsychotics, first- (conventional) and second- (atypical) generation (*see online for full list*)

Avoid use for behavioral problems of dementia unless non-pharmacologic options have failed and patient is threat to self or others.

Increased risk of cerebrovascular accident (stroke) and mortality in persons with dementia.

QE=Moderate; SR=Strong

Thioridazine
Mesoridazine

Avoid.

Highly anticholinergic and greater risk of QT-interval prolongation.

QE=Moderate; SR=Strong

Barbiturates

- Amobarbital*
- Butabarbital*
- Butalbital
- Mephobarbital*
- Pentobarbital*
- Phenobarbital
- Secobarbital*
-

Avoid.

High rate of physical dependence; tolerance to sleep benefits; greater risk of overdose at low dosages.

QE=High; SR=Strong

TABLE 1: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults

Benzodiazepines

Short- and intermediate-acting:

- Alprazolam Estazolam
- Lorazepam Oxazepam
- Temazepam Triazolam
- Chlorazepate Chlordiazepoxide
- Chlordiazepoxide-amitriptyline
- Clidinium-chlordiazepoxide
- Clonazepam
- Diazepam Flurazepam
- Quazepam

■ Chloral hydrate*

Avoid benzodiazepines (any type) for treatment of insomnia, agitation, or delirium.

Older adults have increased sensitivity to benzodiazepines and decreased metabolism of long- acting agents. In general, all benzodiazepines increase risk of cognitive impairment, delirium, falls, fractures, and motor vehicle accidents in older adults.

May be appropriate for seizure disorders, rapid eye movement sleep disorders, benzodiazepine withdrawal, ethanol withdrawal, severe generalized anxiety disorder, periprocedural anesthesia, end-of-life care.

QE=High; SR=Strong

Avoid.

Tolerance occurs within 10 days and risk outweighs the benefits in light of overdose with doses only 3 times the recommended dose.

QE=Low; SR=Strong

Meprobamate

Avoid.

High rate of physical dependence; very sedating.

QE=Moderate; SR=Strong

TABLE 1: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults

Nonbenzodiazepine hypnotics

- Eszopiclone
- Zolpidem Zaleplon
-

Avoid chronic use (>90 days).

Benzodiazepine-receptor agonists that have adverse events similar to those of benzodiazepines in older adults (e.g., delirium, falls, fractures); minimal improvement in sleep latency and duration.

QE=Moderate; SR=Strong

Ergot mesylates*

Isoxsuprine*

Avoid.

Lack of efficacy.

QE=High; SR=Strong

Endocrine

Androgens

- Methyltestosterone*
- Testosterone

Avoid unless indicated for moderate to severe hypogonadism.

Potential for cardiac problems and contraindicated in men with prostate cancer.

QE=Moderate; SR=Weak

Desiccated thyroid

Avoid.

Concerns about cardiac effects; safer alternatives available.

QE=Low; SR=Strong

TABLE 1: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults

Estrogens with or without progestins

Avoid oral and topical patch. Topical vaginal cream: Acceptable to use low-dose intravaginal estrogen for the management of dyspareunia, lower urinary tract infections, and other vaginal symptoms.

Evidence of carcinogenic potential (breast and endometrium); lack of cardioprotective effect and cognitive protection in older women. Evidence that vaginal estrogens for treatment of vaginal dryness is safe and effective in women with breast cancer, especially at dosages of estradiol <25 mcg twice weekly.

*QE=High (Oral and Patch), Moderate (Topical);
SR=Strong (Oral and Patch), Weak (Topical)*

Growth hormone

Avoid, except as hormone replacement following pituitary gland removal.

Effect on body composition is small and associated with edema, arthralgia, carpal tunnel syndrome, gynecomastia, impaired fasting glucose.

QE=High; SR=Strong

Insulin, sliding scale

Avoid.

Higher risk of hypoglycemia without improvement in hyperglycemia management regardless of care setting.

QE=Moderate; SR=Strong

Megestrol

Avoid.

Minimal effect on weight; increases risk of thrombotic events and possibly death in older adults.

QE=Moderate; SR=Strong

TABLE 1: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults

Sulfonylureas, long-duration

- Chlorpropamide
- Glyburide

Avoid.

Chlorpropamide: prolonged half-life in older adults; can cause prolonged hypoglycemia; causes SIADH. Glyburide: higher risk of severe prolonged hypoglycemia in older adults.

QE=High; SR=Strong

Gastrointestinal

Metoclopramide

Avoid, unless for gastroparesis.

Can cause extrapyramidal effects including tardive dyskinesia; risk may be further increased in frail older adults.

QE=Moderate; SR=Strong

Mineral oil, given orally

Avoid.

Potential for aspiration and adverse effects; safer alternatives available.

QE=Moderate; SR=Strong

Trimethobenzamide

Avoid.

One of the least effective antiemetic drugs; can cause extrapyramidal adverse effects.

QE=Moderate; SR=Strong

Meperidine

Avoid.

Not an effective oral analgesic in dosages commonly used; may cause neurotoxicity; safer alternatives available.

QE=High; SR=Strong

TABLE 1: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults

Non-COX-selective NSAIDs, oral

- Aspirin >325 mg/day
- Diclofenac
- Diflunisal Etodolac
- Fenoprofen
- Ibuprofen
- Ketoprofen
- Meclofenamate
- Mefenamic acid
- Meloxicam
- Nabumetone
- Naproxen
- Oxaprozin
- Piroxicam Sulindac
- Tolmetin
-

Avoid chronic use unless other alternatives are not effective and patient can take gastroprotective agent (proton-pump inhibitor or misoprostol).

Increases risk of GI bleeding/peptic ulcer disease in high-risk groups, including those ≥ 75 years old or taking oral or parenteral corticosteroids, anticoagulants, or antiplatelet agents. Use of proton pump inhibitor or misoprostol reduces but does not eliminate risk. Upper GI ulcers, gross bleeding, or perforation caused by NSAIDs occur in approximately 1% of patients treated for 3–6 months, and in about 2%–4% of patients treated for 1 year. These trends continue with longer duration of use.

QE=Moderate; SR=Strong

Indomethacin

Ketorolac, includes parenteral

-
-

Avoid.

Increases risk of GI bleeding/peptic ulcer disease in high-risk groups (See Non-COX selective NSAIDs).

Of all the NSAIDs, indomethacin has most adverse effects.

QE=Moderate (Indomethacin), High (Ketorolac); SR=Strong

Pentazocine*

Avoid.

Opioid analgesic that causes CNS adverse effects, including confusion and hallucinations, more commonly than other narcotic drugs; is also a mixed agonist and antagonist; safer alternatives available.

QE=Low; SR=Strong

TABLE 1: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults

Skeletal muscle relaxants

- Carisoprodol
- Chlorzoxazone
- Cyclobenzaprine
- Metaxalone
- Methocarbamol
- Orphenadrine
-

Avoid.

Most muscle relaxants poorly tolerated by older adults, because of anticholinergic adverse effects, sedation, increased risk of fractures; effectiveness at dosages tolerated by older adults is questionable.

QE=Moderate; SR=Strong

*Infrequently used drugs. Table 1 Abbreviations: ACEI, angiotensin converting-enzyme inhibitors; ARB, angiotensin receptor blockers; CNS, central nervous system; COX, cyclooxygenase; CrCl, creatinine clearance; GI, gastrointestinal; NSAIDs, nonsteroidal anti-inflammatory drugs; SIADH, syndrome of inappropriate antidiuretic hormone secretion; SR, Strength of Recommendation; TCAs, tricyclic antidepressants; QE, Quality of Evidence

From <http://www.americangeriatrics.org/files/documents/beers/PrintableBeersPocketCard.pdf>. Source: AGS.

TABLE 2: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults Due to Drug-Disease or Drug-Syndrome Interactions That May Exacerbate the Disease or Syndrome

Disease or Syndrome	Drug(s)	Recommendation , Rationale, <i>Quality of Evidence (QE) & Strength of Recommendation (SR)</i>
<i>Cardiovascular</i>		
Heart failure	NSAIDs and COX-2 inhibitors Nondihydropyridine CCBs (avoid only for systolic heart failure) <ul style="list-style-type: none"> ■ Diltiazem ■ Verapamil Pioglitazone, rosiglitazone Cilostazol Dronedarone	Avoid. Potential to promote fluidretention and/or exacerbate heart failure. <i>QE=Moderate (NSAIDs, CCBs, Dronedarone), High (Thiazolidinediones (glitazones)), Low (Cilostazol); SR=Strong</i>
Syncope	Acetylcholinesterase inhibitors (AChEIs) Peripheral alpha blockers <ul style="list-style-type: none"> ■ Doxazosin ■ Prazosin ■ Terazosin Tertiary TCAs Chlorpromazine, thioridazine, and olanzapine	Avoid. Increases risk of orthostatic hypotension or bradycardia. <i>QE=High (Alpha blockers), Moderate (AChEIs, TCAs and antipsychotics); SR=Strong (AChEIs and TCAs), Weak (Alpha blockers and antipsychotics)</i>
<i>Central Nervous System</i>		
Chronic seizures or epilepsy	Bupropion Chlorpromazine Clozapine Maprotiline Olanzapine Thioridazine Thiothixene Tramadol	Avoid. Lowers seizure threshold; may be acceptable in patients with well-controlled seizures in whom alternative agents have not been effective. <i>QE=Moderate; SR=Strong</i>

TABLE 2: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults Due to Drug-Disease or Drug-Syndrome Interactions That May Exacerbate the Disease or Syndrome

Delirium	<p>All TCAs</p> <p>Anticholinergics (<i>see online for full list</i>)</p> <p>Benzodiazepines Chlorpromazine</p> <p>Corticosteroids</p> <p>H₂-receptor antagonist Meperidine</p> <p>Sedative hypnotics Thioridazine</p>	<p>Avoid.</p> <p>Avoid in older adults with or at high risk of delirium because of inducing or worsening delirium in older adults; if discontinuing drugs used chronically, taper to avoid withdrawal symptoms.</p> <p><i>QE=Moderate; SR=Strong</i></p>
Dementia & cognitive impairment	<p>Anticholinergics (<i>see online for full list</i>)</p> <p>Benzodiazepines</p> <p>H₂-receptor antagonist Zolpidem</p> <p>Antipsychotics, chronic and as- needed use</p>	<p>Avoid.</p> <p>Avoid due to adverse CNS effects.</p> <p>Avoid antipsychotics for behavioral problems of dementia unless non-pharmacologic options have failed and patient is a threat to themselves or others.</p> <p>Antipsychotics are associated with an increased risk of cerebrovascular accident (stroke) and mortality in persons with dementia.</p> <p><i>QE=High; SR=Strong</i></p>
History of falls or fractures	<p>Anticonvulsants Antipsychotics</p> <p>Benzodiazepines</p> <p>Nonbenzodiazepine hypnotics</p> <ul style="list-style-type: none"> ■ Eszopiclone ■ Zaleplon Zolpidem <p>TCAs/SSRIs</p>	<p>Avoid unless safer alternatives are not available; avoid anticonvulsants except for seizure.</p> <p>Ability to produce ataxia, impaired psychomotor function, syncope, and additional falls; shorter-acting benzodiazepines are not safer than long-acting ones.</p> <p><i>QE=High; SR=Strong</i></p>

TABLE 2: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults Due to Drug-Disease or Drug-Syndrome Interactions That May Exacerbate the Disease or Syndrome

<p>Insomnia</p>	<p>Oral decongestants</p> <ul style="list-style-type: none"> ■ Pseudoephedrine ■ Phenylephrine Stimulants ■ Amphetamine ■ Methylphenidate Pemoline ■ Theobromines Theophylline ■ Caffeine ■ <p>TCA/SSRIs</p>	<p>Avoid.</p> <p>CNS stimulant effects.</p> <p><i>QE=Moderate; SR=Strong</i></p>
<p>Parkinson's disease</p>	<p>All antipsychotics (see online publication for full list, except for quetiapine and clozapine)</p> <p>Antiemetics Metoclopramide</p> <ul style="list-style-type: none"> ■ Prochlorperazine ■ Promethazine 	<p>Avoid.</p> <p>Dopamine receptor antagonists with potential to worsen parkinsonian symptoms.</p> <p>Quetiapine and clozapine appear to be less likely to precipitate worsening of Parkinson disease.</p> <p><i>QE=Moderate; SR=Strong</i></p>
<p><i>Gastrointestinal</i></p>		
<p>Chronic constipation</p>	<p>Oral antimuscarinics for urinary incontinence</p> <ul style="list-style-type: none"> ■ Darifenacin ■ Fesoterodine ■ Oxybutynin (oral) ■ Solifenacin ■ Tolterodine ■ Trospium ■ <p>Nondihydropyridine CCB</p> <ul style="list-style-type: none"> ■ Diltiazem ■ Verapamil 	<p>Avoid unless no other alternatives.</p> <p>Can worsen constipation; agents for urinary incontinence: antimuscarinics overall differ in incidence of constipation; response variable; consider alternative agent if constipation develops.</p> <p>Quetiapine and clozapine appear to be less likely to precipitate worsening of Parkinson disease.</p>

TABLE 2: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults Due to Drug-Disease or Drug-Syndrome Interactions That May Exacerbate the Disease or Syndrome

OE=High (For Urinary Incontinence), Moderate/Low (All Others); SR=Strong

First-generation antihistamines as single agent or part of combination products

- Brompheniramine (various)
- Carbinoxamine
- Chlorpheniramine Clemastine
- (various) Cyproheptadine
- Dexbrompheniramine
- Dexchlorpheniramine (various)
- Diphenhydramine
- Doxylamine
- Hydroxyzine
- Promethazine
- Triprolidine

Anticholinergics/antispasmodics (see online for full list of drugs with strong anticholinergic properties)

- Antipsychotics
- Belladonna alkaloids
- Clidinium-chlordiazepoxide
- Dicyclomine
- Propantheline
- Scopolamine
- Tertiary TCAs (amitriptyline, clomipramine, doxepin, imipramine, and trimipramine)

TABLE 2: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults Due to Drug-Disease or Drug-Syndrome Interactions That May Exacerbate the Disease or Syndrome

History of gastric or duodenal ulcers	Aspirin (>325 mg/day) Non-COX-2 selective NSAIDs	<p>Avoid unless other alternatives are not effective and patient can take gastroprotective agent (proton-pump inhibitor or misoprostol).</p> <p>May exacerbate existing ulcers or cause new/additional ulcers.</p> <p><i>QE=Moderate; SR=Strong</i></p>
<i>Kidney/Urinary Tract</i>		
Chronic kidney disease stages IV and V	NSAIDs Triamterene (alone or in combination)	<p>Avoid.</p> <p>May increase risk of kidney injury.</p> <p>May increase risk of acute kidney injury.</p> <p><i>QE=Moderate (NSAIDs), Low (Triamterene); SR=Strong (NSAIDs), Weak (Triamterene)</i></p>
Urinary incontinence (all types) in women	Estrogen oral and transdermal (excludes intravaginalestrogen)	<p>Avoid in women. Aggravation of incontinence. <i>QE=High; SR=Strong</i></p>
Lower urinary tract symptoms, benign prostatic hyperplasia	Inhaled anticholinergic agents Strongly anticholinergic drugs, except antimuscarinics for urinary incontinence (see Table 9 for complete list).	<p>Avoid in men.</p> <p>May decrease urinary flow and cause urinary retention.</p> <p><i>QE=Moderate; SR=Strong (Inhaled agents), Weak (All others)</i></p>
Stress or mixed urinary incontinence	Alpha-blockers <ul style="list-style-type: none"> ■ Doxazosin ■ Prazosin ■ Terazosin 	<p>Avoid in women. Aggravation of incontinence. <i>QE=Moderate; SR=Strong</i></p>

TABLE 2: 2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults Due to Drug-Disease or Drug-Syndrome Interactions That May Exacerbate the Disease or Syndrome

Table 2 Abbreviations: CCBs, calcium channel blockers; AChEIs, acetylcholinesterase inhibitors; CNS, central nervous system; COX, cyclooxygenase; NSAIDs, nonsteroidal anti-inflammatory drugs; SR, Strength of Recommendation; SSRIs, selective serotonin reuptake inhibitors; TCAs, tricyclic antidepressants; QE, Quality of Evidence

From <http://www.americangeriatrics.org/files/documents/beers/PrintableBeersPocketCard.pdf>. Source: AGS.

TABLE 3: 2012 AGS Beers Criteria for Potentially Inappropriate Medications to Be Used with Caution in Older Adults

Drug(s)	Recommendation , Rational, <i>Quality of Evidence (QE) & Strength of Recommendation (SR)</i>
Aspirin for primary prevention of cardiac events	<p>Use with caution in adults ≥80 years old.</p> <p>Lack of evidence of benefit versus risk in individuals ≥80 years old.</p> <p><i>QE=Low; SR=Weak</i></p>
Dabigatran	<p>Use with caution in adults ≥75 years old or if CrCl <30 mL/min.</p> <p>Increased risk of bleeding compared with warfarin in adults ≥75 years old; lack of evidence for efficacy and safety in patients with CrCl <30 mL/min</p> <p><i>QE=Moderate; SR=Weak</i></p>
Prasugrel	<p>Use with caution in adults ≥75 years old.</p> <p>Greater risk of bleeding in older adults; risk may be offset by benefit in highest-risk older patients (eg, those with prior myocardial infarction or diabetes).</p> <p><i>QE=Moderate; SR=Weak</i></p>
Antipsychotics Carbamazepine Carboplatin Cisplatin Mirtazapine SNRIs SSRIs TCAs Vincristine	<p>Use with caution.</p> <p>May exacerbate or cause SIADH or hyponatremia; need to monitor sodium level closely when starting or changing dosages in older adults due to increased risk.</p> <p><i>QE=Moderate; SR=Strong</i></p>
Vasodilators	<p>Use with caution.</p> <p>May exacerbate episodes of syncope in individuals with history of syncope.</p> <p><i>QE=Moderate; SR=Weak</i></p>

TABLE 3: 2012 AGS Beers Criteria for Potentially Inappropriate Medications to Be Used with Caution in Older Adults

Table 3 Abbreviations: CrCl, creatinine clearance; SIADH, syndrome of inappropriate antidiuretic hormone secretion; SSRIs, selective serotonin reuptake inhibitors; SNRIs, serotonin–norepinephrine reuptake inhibitors; SR, Strength of Recommendation; TCAs, tricyclic antidepressants; QE, Quality of Evidence

From <http://www.americangeriatrics.org/files/documents/beers/PrintableBeersPocketCard.pdf>. Source: AGS.

Numerous studies have helped produce evidence-based practice standards and guidelines for the most commonly misused medications. However, inappropriate prescribing is difficult to manage. Research constantly identifies more problematic medications. In addition, deciding when a medication is inappropriate because of medical condition, genetic predisposition, medical illiteracy, or age is a complex task. Recognizing the serious scope of potential dangers to our elders requires being alert to polypharmacy when caring for older adults.

Test Your Knowledge

Inappropriate prescribing is difficult to manage because:

- A. Names of medications are often similar.
- B. Patients don't follow directions.
- C. There are many medications questionable for older adults.
- D. There are too few drugs from which to choose.

Apply Your Knowledge

Q: Where can you go to look up questionable medications based on research studies?

A: The Beers Criteria is found online with lists and updates at <https://www.guideline.gov/summaries/summary/49933>.

Answer: C

Additional Screening Strategies

Screening strategies include the STOPP and START, which guide healthcare professionals to the right treatments and away from potentially inappropriate prescriptions, respectively, and the ARMOR tool to guide in choosing the correct medication.

STOPP/START

Further attempts to address the complex issue of polypharmacy include START (Screening Tool to Alert doctors to the Right Treatments) and STOPP (Screening Tool of Older Persons Potentially inappropriate Prescriptions) (Hamilton et al., 2011). These criteria were developed to address both **errors of omission**—failure to use an appropriate drug when indicated, ie, use of an ACE Inhibitor in a diabetic patient for renal protection—and **errors of commission**.

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STOPP/START addresses common prescribing patterns seen in older patients, including:

- Use of a loop diuretic (furosemide) for ankle edema with no clinical evidence of heart failure
- Use of tricyclic antidepressants (eg, amitriptyline) in a patient with glaucoma (likely to cause exacerbation)
- Vasodilator drugs (nitroglycerine, various forms) in a patient with persistent postural hypotension (> 20 mmHg drop in systolic blood pressure with position change), increasing the risk of syncope and falls
- Duplication within a drug class (opiates, others) without first optimizing monotherapy and other choices.

The ARMOR TOOL

The Armor Tool (Hague, 2009) is an additional attempt to consolidate recommendations into a functional and interactive tool easily implemented to address polypharmacy. It uses the mnemonic device ARMOR to help shield patients from inappropriate prescription of ineffective and possibly harmful medications:

- **A:** Assess (medications)
- **R:** Review (interactions: drug-drug, drug-disease, ADR) **M:** Minimize (number of drugs and functional status) **O:** optimize (for renal/hepatic clearance)
- **R:** Re-assess (functional/cognitive /clinical status; compliance) to improve functional status (Hague, 2009)

This tool takes into account the patient's clinical profile and functional status and seeks to balance evidence-based practice guidelines for pharmacologic treatment suggestions with altered physiologic states. ARMOR approaches polypharmacy in a systematic fashion with the goal of restoring and/or maintaining functional status. The ARMOR tool also emphasizes quality of life and patient preferences as key factors to consider when changing or discontinuing medications.

Implementation of ARMOR has the additional advantage of utilizing a multidisciplinary approach including input from physicians, nurses, pharmacists, physical and occupational therapists, and others, in an attempt to consider the patient in their fullest dynamic. It is meant to be used in the geriatric person who is:

- Receiving 9 or more medications
- Seen for an initial assessment
- Being evaluated for
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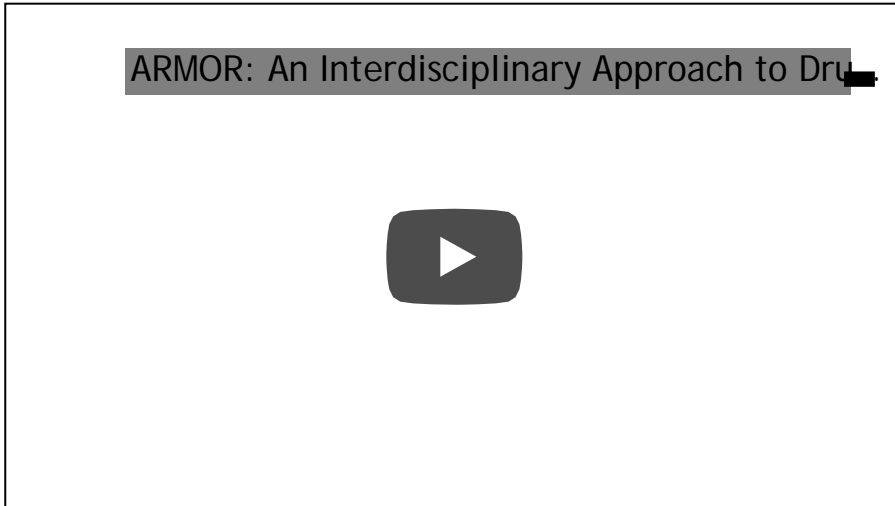
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Apply Your Learning

Try to use the BEERS criteria or ARMOR mnemonic this week on one of your patients, (if you don't already) to assess for medication safety.

Online Resources

Video (4:42): ARMOR: An Interdisciplinary Approach



to Drug Safety

<https://www.youtube.com/watch?v=sUM9BZy8iUK>

Adverse Effects of Overmedication

Leona's symptoms of slurred speech, disorientation, and confusion are classic for overmedication. Leona also experienced drowsiness and slight confusion, which she mistakenly identified as normal for her since she is aging. When she woke up from her second daytime nap, she stumbled to get up to the bathroom and thought it was just because she was still drowsy.

She had to brace herself against the wall down the hall to the bathroom and passed it off to her being clumsy. After speaking to her son on the phone she couldn't remember what the conversation was about. Her husband, who takes eight medications for his own declining health, wasn't able to identify her changing behavior nor associate it with overmedication use.

Healthcare providers need to be alert to the potential for polypharmacy and its complications. It is essential to identify risk factors in the patients we treat in order to manage medications appropriately (see table below).

Risks Overview

Polypharmacy increases the risk of potentially inappropriate prescriptions, cognitive

disorders, falls, hip fractures, depression, and incontinence. Inappropriate medications complicate polypharmacy because many of the drugs classified as potentially inappropriate are associated with ADRs, some offer little or no advantage over other safer drugs, and some have a

long half-life in older patients (Lococo & Staplin, 2006).

Classes of medications that have been linked to increased fall risk, especially in elders, include nonsteroidal anti-inflammatory drugs (NSAIDs), benzodiazepines, anticholinergics, opioids, antidepressants, and neuroleptics (Ponce, 2012; CDC, 2007). It is recommended that each of these medications begin at low-dose entry levels and titrate upward slowly as needed. Careful

Risk Factors for Adverse Effects from Polypharmacy		
Category	Characteristic(s) indicating high risk	
Age	Over 75 years of age	
Living situation	Living alone or with an elderly spouse	
Medications	Taking multiple drugs, OTC, social drugs	
Medical	<ul style="list-style-type: none"> ■ Multiple prescribers, such as physicians, psychiatrists, dentists, podiatrists, or nurse practitioners ■ Multiple medical problems ■ Multiple caregivers ■ Poor communication between older patients and health professionals 	
Cognition	<ul style="list-style-type: none"> ■ Impaired alertness or memory ■ Psychiatric problems ■ Inability to take medications as directed 	
Physical	<ul style="list-style-type: none"> ■ Appears weak and with impaired mobility ■ Needing a walker or cane 	

Source: Lococo & Staplin, 2006.

Risk for Falls

It has been well-established that polypharmacy is a risk factor for falls. An estimated 30% of elders report falling each year, and falls claim the leading cause of fatal and nonfatal injuries among adults age 65 and older (CDC, 2016b). In 2014, based on the Behavioral Risk Factor Surveillance System (BRFSS) survey, an estimated 27,000 older adults died because of falls, 800,000 were hospitalized, and 2.8 million were treated in emergency departments (Eds) for falls. In a single year, 30% of people over 65 years of age and 50% of those age 80 or older will fall (Masud & Morris, 2001).

monitoring should be done within the first 2 weeks of drug therapy with benzodiazepines, opioids and antidepressants when the fall and fracture risk is highest.

Assessment tools have been created, and there are even screening tools for fall-risk prediction in elders (Bongue et al., 2010). The Home Health Quality Improvement organization has gathered helpful research and created practice guidelines for medication management. Physicians, nurse practitioners, and physical therapists have also identified key factors that need to be assessed for fall and fracture risk. They include the following:

- Postural hypotension
- Use of sedatives
- Use of at least four prescription medications
- Impairment in arm or leg strength or range of motion
- Balance
- Ability to move safely from bed to chair or to the bathtub or toilet (transfer skills)
- Gait

Less well known is that fall risk can increase significantly in the days following a medication change. In October 2004, researchers at Johns Hopkins University studied the effect of medication changes on the risk of falls among residents of three nursing homes who fell during 2002–2003. The study looked at medication changes that occurred 1 to 9 days before the fall, including the odds ratio of falling after a start, stop, or dose change in medication in the case time period versus the control time period (CDC, 2007; Van Der Velde et al., 2006; Zhan, 2001).

The results indicated that the short-term risk of single and recurring falls may triple within 2 days after a medication change. The Johns Hopkins study outcomes may be used to develop similar fall risk studies in other clinical settings; to identify high-risk times for falls depending on medication changes; and to develop intensive, short-term interventions for vulnerable residents after medication changes (CDC, 2007).

A prospective study completed on patients who had a fall risk followed by a drug discontinued revealed a statistically significant improvement in fall reduction—especially after withdrawal of cardiovascular drugs that put the patient at risk for orthostatic hypotension (Van der Velde, 2006).

Another strategy to decrease fall risk is to complete a **medication reconciliation** at every medical office visit or hospitalization. It is the process of creating an updated list of all the current medications a patient may be receiving and includes the dosage, route, time, purpose, and frequency of the drug. Both generic and brand names

should be identified so as not to duplicate drugs. Many times a patient may be confused and be taking the drug twice as often as prescribed because the names are different even when the drug is the same.

Physicians, physician assistants, nurse practitioners

ers, nurses and other healthcare professionals should complete medication reconciliation upon hospital admission and discharge, home visits, care plan reviews, annual comprehensive exams, office visits, and any time the patient is being transferred from one facility to another or has medication changes.

Answer: C

In 2015 the National Council on Aging, Center for Healthy Aging, issued the updated Falls- Free National Action Plan, in which they urged healthcare professionals to support policies that increase awareness of polypharmacy and fall risk. The goal of the call to action is to

increase the number of older adults who have annual medication reviews conducted by healthcare providers or pharmacists and ensure this review includes an adequate focus on falls and fall-related injury prevention, with the goal of reducing or eliminating medications that increase fall risk. (NCOA, 2015)

To address this goal, clinicians should regularly review each patient's medications for potential interactions and side effects that may increase fall risk and, where possible, reduce or eliminate medications or select alternatives. Reducing the number and types of medications—particularly tranquilizers, sleeping pills, and anti-anxiety drugs—can be an effective fall prevention strategy when used alone or as part of a multi-component intervention (NCOA, 2015).

Test Your Knowledge

The risk for falls:

- A. Lessens in those relaxed through use of anti-anxiety drugs.
- B. Is generally related to impulsive behavior.
- C. May triple within two days of a medication change.
- D. Is decreased when older adults remain in the home.

Answer: C

Apply Your Learning

Q: What can you do for your patients to help assess for and prevent falls?

A: According to HHQI, you can use many fall assessment tools including the Get Up and Go test and fall risk tools such as the Fall MedQIC Fall Risk form, which answers questions about past falls, number of medications prescribed, physical strength, confusion, orientation status, and more, to come up with a number that quantifies the patient's fall risk. Download the form at:

<http://www.homehealthquality.org/Education/Best-Practices/BPIPs/Fall-Prevention-BPIP.aspx>. Teaching the patient about the purpose of their medications can also help them evaluate the medication's usefulness.

Improving Medication Management

In the PCP's office a nurse met with Leona to complete her medication reconciliation and discuss a plan to avoid overmedication. He provided a pill box that allows Leona to put her daily medications in each section so she could tell when the medications had been taken. He also offered alternative methods that Leona could use, including a dry-erase board showing her daily medication times, an alarm system for her phone, and an updated printout of the names of her medications and why she was taking each one.

The nurse also helped Leona order a medication-alert necklace. Leona and her husband both liked the simple pill box method. They even took a picture to show what the pill box should look like with all her colored medications as well as the pill bottles, so they would have a visual reminder of each week as they filled the boxes. They were also taught the symptoms to look for in case of any future accidental drug overdosing.

Because older adults must manage a plethora of chronic illnesses with medications, it is critical to ensure that each medication is essential and taken as prescribed. When financial resources are stretched, elders may be inclined to extend medications by creative self-administration strategies.

Elders with low income, those without adequate prescription drug coverage, and those using high-cost medications are likely to stretch out their medication supply by skipping doses or extending the intervals between doses—or cutting the pills in half. Strategies to decrease the number of tablets needed include taking a smaller dose (splitting tablets or taking one when multiple tablets are prescribed) and substituting an OTC or herbal alternative. Taking a lower-than-prescribed dose is especially prevalent in patients with multiple medical conditions using many medications, those prone to medication side effects, and people who resist prescribed treatment due to personal or cultural beliefs.

Although these activities are not in the realm of polypharmacy per se, they are related, in that appropriate prescribing ensures that older adults purchase only the medications they need. Left to decide which medication to extend, the older person may neglect taking a critical medication such as an anti-hypertensive and continue taking a noncritical medication. Hypertension is asymptomatic, so an older adult might favor taking a proton pump inhibitor (PPI) for gastric discomfort and skip doses of the antihypertensive to save money.

A wise healthcare professional may identify the PPI as an expensive medication that might be substituted for a less expensive but effective alternative (in this case, an H2-blocker might work). Identifying problems such as this in a medication regimen could potentially reduce the overall cost of medications for the patient so that both the anti-hypertensive and an effective remedy for gastric discomfort can be afforded.

Additionally, taking the time with the patient to explore nonpharmacologic treatments such as weight loss, exercise, and modifications to the diet to decrease gastric acid production should be considered. Unfortunately, often the patient and the clinician rely on pharmacologic interventions because behavior modification is more challenging and often doesn't create results as quickly.

Recommendations designed to improve medication management in older adults include the following (Conn et al., 2009):

- Reduce inappropriate prescribing
- Decrease polypharmacy
- Avoid adverse events
- Maintain functional status
-

Drug education

- Simple written instructions
- Dose modification (to reduce frequency and number of medications) Disease education
- Medication reconciliation and review
- Packaging (use of pill boxes, pill blisters to identify separate doses) Side effect management
- Tailored interventions (versus standardized dosing recommendations)
- Medication self-monitoring (medication diary and calendar as reminders to take medications)
- Written calendar
- Disease and symptom monitoring
- Integration of provider care
- Use of alternative therapies rather than relying on pharmacotherapy
- Use of one pharmacy for all medications

Reducing Inappropriate Prescribing

A number of studies have looked at methods to reduce inappropriate prescribing for older adults. Evidence supports the following practice guidelines:

- Incorporate pharmacist recommendations Use computerized alerts
- Review patient's medication list regularly
- Utilize patient education (Garcia, 2006)

Prescribers should practice the following measures (Kaur et al., 2009):

- Ask the patient to bring all medications being taken, both prescribed and OTC, to the primary care provider who can evaluate all medications being taken, especially if there are multiple physicians prescribing medications
- Discontinue medications found to be in conflict with Beers or other criteria unless compelling evidence exists for continuance
- Reinforce use of a single pharmacy for all prescription medications
- Follow treatment guidelines for chronic and acute disorders that affect older adults Identify methods for payment other than giving drug samples
- Provide Medicare prescription information
- Consider generic drugs
- Use pre-filled drug boxes and regular reminders to improve adherence
- Work with your patient to design a system for remembering the medication regimen (Conn et al., 2009)

Decreasing Polypharmacy

Inappropriate prescribing and polypharmacy are closely linked. Evidence suggests that both can be reduced by up to 25% by utilizing a pharmacist to review the patient's chart and medication list (Garcia, 2006).

Other recommendations to reduce polypharmacy include:

- Use combination drugs or tablets and alternative routes Use one-a-day dosing when possible
- Avoid prescribing medications to counteract the effects of other medications
- Monitor lab results at regular intervals; assess for known toxicities at each visit Screen for drug interactions (Bergman-Evans, 2004)

Avoiding Adverse Events and Reactions

An adverse drug *event* (ADE) is defined as "an injury resulting from the use of a drug." Adverse drug events include "expected adverse drug reactions (or side effects) as well as events due to errors." Adverse drug events due to errors are, by definition, preventable (Lococo & Staplin, 2006).

In contrast, an adverse drug *reaction* (ADR) is "any response to a drug which is noxious and unintended, and which occurs at doses normally used in humans for prophylaxis, diagnosis, or therapy of disease, or for the modification of physiologic function." This definition implies that there was no error in the use of the drug. Examples of an injury include:

- A rash or diarrhea caused by an antibiotic/anti-infective agent
- Gastrointestinal tract events such as nausea, vomiting, diarrhea, constipation, and abdominal pain
- Anaphylaxis (a serious allergic reaction) to penicillin
- A major hemorrhage from a blood-thinning agent
- Kidney failure from aminoglycosides (antibiotics often administered into veins or muscle to treat serious bacterial infections) (Lococo & Staplin, 2006)

Adverse events can be categorized as fatal, life-threatening, serious, or significant. Events resulting in permanent disability included stroke, intracranial bleeding events, hemorrhagic injury to the eye, and drug-induced pulmonary injury. Deaths in one study were related to fatal bleeding, peptic ulcers, neutropenia/infection, hypoglycemia, drug toxicity related to lithium or digoxin, anaphylaxis, and complications of antibiotic-associated diarrhea (Lococo & Staplin, 2006).

In the same study, the most common types of preventable adverse drug events were:

- Electrolyte/renal (27%)
- Gastrointestinal tract (21%)
- Hemorrhagic (16%)
- Metabolic/endocrine (14%)
- Neuropsychiatric (9%)

The most common medication categories associated with preventable ADEs were:

- Cardiovascular medications (24.5% of the ADEs)
- Diuretics (22.1% of the ADEs)
- Nonopioid analgesics (15.4% of the ADEs)
- Hypoglycemics (10.9% of the ADEs)
- Anticoagulants (10.2% of the ADEs) (Lococo & Staplin, 2006)

Adverse drug events can result from errors in prescribing or administering medication or from patient noncompliance. The percentage of community-dwelling elder Americans who had at least 1 of the 33 drugs considered potentially inappropriate for older adults improved significantly from 21.3% in 1996 to 18.4% in 2002. The percentage of community-dwelling elders who had 1 of 11 drugs that should always be avoided by older adults remained at about 3% over the 6-year time period between 1996 and 2002 (AHRQ, 2015).

An analysis of ED visits between 1992 and 2000 of patients 65 and older estimated that inappropriate medications were given in 12.6% of the visits. The top six drugs involved in inappropriate administration (accounting for 70.8% of all cases) were promethazine (22.2%), meperidine (18.0%), propoxyphene (17.2%), hydroxyzine (10.3%), diphenhydramine (7.1%), and diazepam (6.0%) (Zagaria, 2006).

Propoxyphene (Darvon) has been discontinued due to cardiac events; meperidine is known to have paradoxical excitatory effects in patients, producing a range of symptoms from tremor to myoclonus and seizure. Many persons having a seizure following exposure to meperidine might then be placed long-term on an anti-convulsant medication to control a medication-related incident, thereby compounding the list of medications a patient is receiving.

The great irony in medicine is of giving a patient a medication for a disease, and then another medication for its side effects, and following it with another medication or two or more to counter those side effects—and the negative vicious cycle continues.

Often, any diagnosis indicating an appropriate use of these medications is absent, or testing confirming the ongoing need for medication is omitted. The practice then becomes one of continuation without questioning. This practice is perpetuated when the patient does not have a consistent medical provider or medical home.

In elders, lower initial doses should be used and upward titration done at a slower rate than in younger patients. Use of a single medication within a class should be optimized before a second medication from the same class is added, and the patient should always be carefully questioned to determine that the desired effect from a medication is achieved. Side effects and the desired outcome of the medication should be agreed upon with the patient rather than just a clinician-based decision.

Pharmacokinetics and the Aging Process

Pharmacokinetics is the study of the absorption, distribution, metabolism, and excretion (ADME) of drugs. Changes associated with aging affect the pharmacokinetics of medications. Once taken, a medication must obtain therapeutic levels in the bloodstream to exert a clinical action. This section discusses how normal changes of aging and alterations due to age-related conditions affect the body's response to polypharmacy.

Absorption

Drugs are administered orally, parenterally, or topically. Drugs taken orally are absorbed in the gastrointestinal (GI) tract. Drugs administered parenterally are absorbed by the vascular circulation, while topical drugs are absorbed by skin or mucosa. Incomplete absorption of orally administered drugs occurs mainly because of lack of absorption from the gut. If a drug is too **hydrophilic** (easily absorbed by or dissolved in water) it will have trouble crossing the cell's lipid membrane. If a drug is too **lipophilic** (fat-soluble) it will not be soluble enough to cross the water layer surrounding the cell (Marieb & Hoehn, 2016).

Following administration of a drug by any route, some fraction of the unchanged drug will reach the systemic circulation. The amount of drug reaching the systemic circulation after administration is referred to as its **bioavailability**. In general, absorption is unchanged in later adulthood; however, there are some important changes to consider related to aging.

Age-related changes can impede absorption due to decreased blood flow to the tissues and the GI tract and changes in gastric pH (Marieb & Hoehn, 2016). In most older adults, this normative change of aging has no clinical consequence; however, the use of certain medications can enhance this effect and alter absorption significantly. For example, proton pump inhibitors (PPIs) such as omeprazole lower gastric pH and can inhibit Vitamin B12 absorption (Marieb & Hoehn, 2016). Elders should take PPIs for the least time necessary to ameliorate the condition they are meant to treat. An older adult taking a PPI for a prolonged period of time should have periodic monitoring of vitamin B12 or take supplements.

Chronic illness and age-related variations in plasma proteins may also cause significant problems with medications that are highly protein bound, such as phenytoin and levodopa/carbidopa. Blood levels can vary, especially if food intake and dosing are not consistent. For example, if phenytoin is taken with a high-protein meal, less medication is absorbed, because phenytoin binds with the protein in the stomach.

Decreased cardiac output in older adults and those with chronic conditions may reduce subcutaneous and intramuscular drug absorption, thus affecting the pharmacokinetics of injectable medications. Transdermal medications are absorbed through subcutaneous fat, which is reduced with aging (Wynne, 2011).

Test Your Knowledge

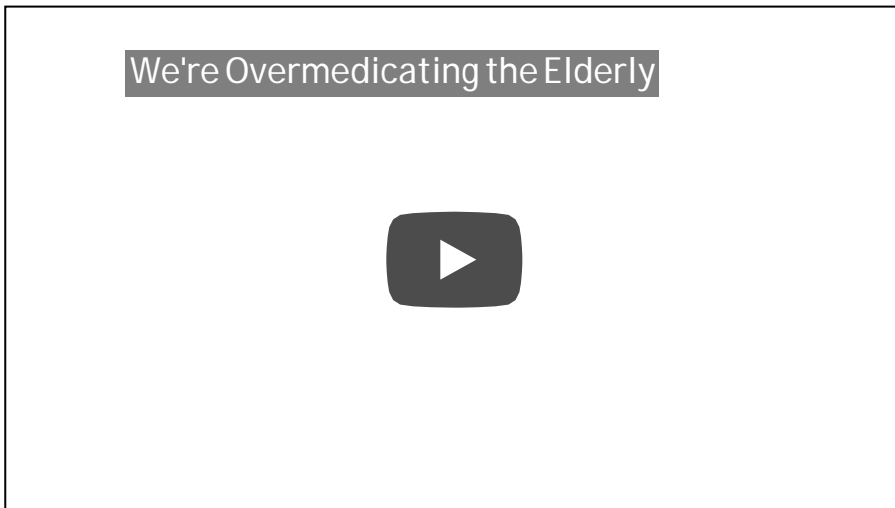
Age-related changes that impact bioavailability of a medication include:

- A. Decreased blood flow to the digestive tract.
- B. Increased oxygen levels in the blood.
- C. Decreased subcutaneous fat.
- D. Increased absorption in the gut.

Answer: C

Online Resource

Video (7:08): We're Overmedicating Elders



<https://www.youtube.com/watch?v=PnZItiKbCUw>

Distribution

Once a medication is absorbed into the bloodstream, it is distributed throughout the body and exerts both desired and undesired effects. Distribution dynamics can be affected by body weight and body composition, which changes with age. Distribution of a medication is also affected by impaired absorption, which influences its onset, strength, and duration.

In general, as we age, total body water and muscle mass decrease while percentage of body fat increases. These changes can lead to drugs having a longer duration of action and increased effect. Drugs that were effective may become compounded and overexceed their therapeutic threshold causing increased side effects.

Protein binding refers to the amount of medication bound to albumin in the blood. It is a theoretical concept that explains variability in pharmacologic distribution. Medications that are highly protein-bound have an affinity for albumin. A bound drug is inactive whereas an unbound drug exerts a pharmacologic effect. Think of the albumin as hands that hold onto drug—the more albumin, the more hands, the less active drug available.

Serum albumin comes from dietary protein and is often decreased in older adults, creating unique issues with medications that are highly protein-bound, such as levodopa, warfarin, and phenytoin. Serum albumin is decreased 15% to 20% compared to the levels in healthy younger adults and is perhaps even lower during times of illness. If an older adult has low albumin, there are fewer “hands” to hold the drug and render it inactive, leaving more drug free and active. This is one reason older adults need a lower dose of medication than younger adults, especially if the drug is highly protein-bound.

Metabolism

Following absorption across the gut wall, drug metabolism occurs almost entirely in the liver. Liver metabolism greatly reduces the bioavailability of medications through a process called **first-pass elimination**, which is the rate at which circulating drugs are metabolized as they traverse the liver before they reach the systemic circulation. First-pass elimination can actually inactivate some drugs, thus requiring alternative routes of administration.

The liver can also excrete the drug into the bile. With age and chronic illness, liver size and hepatic blood flow are decreased, therefore dosing of medications that are significantly metabolized by the liver should be adjusted. In addition, alcohol use should be assessed when prescribing any medications to elders because liver health or disease can modify the drug's effectiveness.

Excretion

Age-related changes in renal function are an important factor in the clearance of drugs from the body. About two-thirds of the population experiences a decline in creatinine clearance with aging. This can lead to a prolonged half-life for many drugs and cause the build-up of toxic levels if the dose and frequency are not adjusted (Katzung, 2012). Renal impairment requires dosage adjustment of medications that are metabolized and excreted by the kidneys. There are two laboratory values commonly used to estimate renal function: creatinine clearance and glomerular filtration rate. Blood urea nitrogen (BUN) and creatinine are commonly tested together and should be tested annually for elders taking more than six medications.

Other Factors

Pharmacodynamics is the effect of the medication on the body (Wynne, 2011, Katzung, 2012). Increased drug actions not explained by changes in pharmacokinetics are often listed as pharmacodynamic actions. For example, receptors and receptor sites in elders, or in those with long-standing illness, may be reduced or limited in function, having the effect of increasing or decreasing sensitivity to drug action. Patients with diabetes mellitus often have decreased insulin receptors, which impact overall glucose levels as well as effects on other medications.

Medication is metabolized according to our individual enzyme systems, which are related to our genes and DNA. Some reactions to medications can be predicted genetically. This is referred to as **pharmacogenetics**. Pharmacogenetics studies and predicts how an individual's genetic inheritance affects the body's response to drugs. Known genetic variants predict that certain individuals will not respond to commonly used medications such as statins, antihypertensives, and SSRIs.

Through the use of pharmacogenetics, more accurate methods of matching a drug with the appropriate patient will be available, as well as better determination of the correct dosage of a certain drug tailored to the individual. Genetic mapping holds great promise (and will soon be available as a tool) for predicting diseases and drug reactions, but it is still too expensive to be widely available.

Test Your Knowledge

Pharmacodynamics refers to the:

- A. Interaction of multiple medications.
- B. Way the body metabolizes the medication.
- C. Energy released by a medication.
- D. Effect of the medication on the body.

Answer: D

Implications for Healthcare Professionals

Despite risks, medications are often needed to maintain health and well-being. Clinicians can help ensure medication safety by keeping current on medication information, reviewing medications frequently to verify need, and educating the patient and family about safe administration practices.

Clinicians have a professional responsibility to keep informed about new medications and new research on medications and their use. Often adverse effects of medications are not known until many people use the medications over a period of time. For example, findings from the Women's Health Initiative (WHI) in 2008 revealed that a widely used exogenous estrogen, thought to be safe and beneficial to postmenopausal women, actually increased risk of breast cancer (Heiss et al., 2008). That research changed the once automatic response to prescribe estrogen for menopausal women.

Between 2003 to 2005, the Food and Drug Administration (FDA) issued a series of black-box warnings regarding potential metabolic and cardiovascular adverse effects from atypical antipsychotic medications (Rosack, 2005, Katzung, 2012). That research changed the first line therapies once prescribed, and now clinicians must look to updated information as medications change frequently from first- to second- and third-generation drugs, with improvements in recommendations.

One maxim of geriatric care (care of older adults) is that it is often more effective to remove a medication than to add one. **Be aware that herbals and supplements can interact with prescribed drugs.** Most of the "herbal antidepressants" are chemically related to MAOIs (monoamine oxidase inhibitors), a drug class that can result in a hypertensive crisis if a minimum 2-week wash-out interval is not observed before starting an SSRI. A **wash-out interval** is the time period to allow the medication to completely be eliminated from the body and is related to the half-life of active ingredients in pharmaceuticals. The half-life varies from medication to medication.

Patients continue to believe that herbal medications are essentially safe, and they are unaware that serious problems can arise when herbals are mixed with other medications. Always inquire about supplements, herbals, and OTC medications when obtaining a medication history. Encourage patients to give this information to their pharmacists as well. Make certain every medication has a current indication and is within the expiration period.

Instruct the patient or family to keep a current record of medications. This list should be in an easily accessible place in the home or in the person's wallet or purse. When working with an older adult who is cognitively impaired, ask the family to designate one caregiver to manage the medications. This representative should be the only person to communicate with healthcare providers about changes in medications.

Consider health literacy and language competence when teaching the patient or family. Provide legible instructions in large type. After giving medication instructions, ask the patient or family member to repeat the instructions back to you to ensure comprehension. Cultural differences may exist as to how they perceive the need for medication. Some cultures have a distrust of Western medicine and may not fully adhere to the instructions; or they may supplement with home remedies or purchased herbal remedies that could counteract or compound the prescribed pharmaceutical.

Test Your Knowledge

When taking a medication history:

- A. Focus exclusively on prescription drugs.
- B. Make certain every medication has a current indication.
- C. Explain that herbals and supplements are not medications.
- D. Advise against taking over-the-counter drugs.

Apply Your Learning

Find the medication list system for your facility and become familiar with how to record the medications and complete a medication reconciliation per your facility.

Answer: B

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Post Test (Overmedication 219)

Use the answer sheet following the test to record your answers.

1. The term *polypharmacy* describes:
 - a. Medications that are synthetic rather than biological.
 - b. Use of multiple medications at one time.
 - c. Buying prescription drugs at more than one pharmacy.
 - d. Getting prescriptions from more than one physician.

2. Risk for adverse drug reactions (ADRs):
 - a. Decreases with age and experience.
 - b. Increases in women of childbearing age.
 - c. Decreases in those who consult multiple specialists.
 - d. Increases as the number of medications increases.

3. In a 12-month study of the scope of polypharmacy, three-quarters of the participant elders were taking six or more prescribed drugs:
 - a. True
 - b. False

4. The Beers criteria are designed to identify:
 - a. Medications inappropriate for use in older adults.
 - b. Practitioners who write too many prescriptions.
 - c. Caregivers who need education in giving medications properly.
 - d. Medications with side effects known to be potentially dangerous.

5. Inappropriate prescribing is difficult to manage because:
 - a. Names of medications are often similar.
 - b. Patients don't follow directions.
 - c. There are many medications questionable for older adults.
 - d. There are too few drugs from which to choose.

6. The risk for falls:
 - a. Lessens in those relaxed through use of anti-anxiety drugs.
 - b. Is generally related to impulsive behavior.
 - c. May triple within two days of a medication change.
 - d. Is decreased when older adults remain in the home.

7. One way to improve medication management is to:
- Reduce the total number of medications to no more than five.
 - Challenge personal or cultural beliefs that interfere.
 - Ensure that the patient is taking medications as prescribed.
 - Encourage creative self-administration.
8. Age-related changes that impact bioavailability of a medication include:
- Decreased blood flow to the digestive tract.
 - Increased oxygen levels in the blood.
 - Decreased subcutaneous fat.
 - Increased absorption in the gut.
9. *Pharmacodynamics refers to the:*
- Interaction of multiple medications.
 - Way the body metabolizes the medication.
 - Energy released by a medication.
 - Effect of the medication on the body.
10. When taking a medication history:
- Focus exclusively on prescription drugs.
 - Make certain every medication has a current indication.
 - Explain that herbals and supplements are not medications.
 - Advise against taking over-the-counter drugs.

Answer Sheet

Overmedication: A Hazard for Elders (219)

Name (Please print your name): Date: _____

Passing score is 80% _____

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____
- 6. _____
- 7. _____
- 8. _____
- 9. _____
- 10. _____

Course Evaluation (Overmedication 219)

Please use this scale for your course evaluation. Items with asterisks * are required.

- 1 = Strongly agree
- 2 = Agree
- 3 = Neutral
- 4 = Disagree
- 5 = Strongly disagree

* Upon completion of the course, I was able to:

a. Identify three problems associated with polypharmacy in elders.

- 1 2 3 4 5

b. Summarize three risks associated with multiple medications.

- 1 2 3 4 5

c. Describe five physiologic changes of aging that impact the efficacy of medications.

- 1 2 3 4 5

d. Distinguish between pharmacokinetics and pharmacodynamics.

- 1 2 3 4 5

e. Explain the overall purpose of the Beers criteria.

- 1 2 3 4 5

f. Describe two additional screening strategies for identifying inappropriate medications for older adults.

- 1 2 3 4 5

g. Identify five adverse results of polypharmacy.

- 1 2 3 4 5

h. Relate three ways in which polypharmacy can increase the risk of falls in older adults.

- 1 2 3 4 5

i. List five ways to improve medication management for elders.

- 1 2 3 4 5

* The author(s) are knowledgeable about the subject matter.

1 2 3 4 5

* The author(s) cited evidence that supported the material presented.

1 2 3 4 5

* Did this course contain discriminatory or prejudicial language?

Yes No

* Was this course free of commercial bias and product promotion?

Yes No

* As a result of what you have learned, do you intend to make any changes in your practice?

Yes No

If you answered Yes above, what changes do you intend to make? If you answered No, please explain why.

* Do you intend to return to ATrain for your ongoing CE needs?

- Yes, within the next 30 days.
- Yes, during my next renewal cycle.
- Maybe, not sure.
- No, I only needed this one course.

* Would you recommend ATrain Education to a friend, co-worker, or colleague?

- Yes, definitely.
- Possibly.
- No, not at this time.

* What is your overall satisfaction with this learning activity?

1 2 3 4 5

* Navigating the ATrain Education website was:

- Easy.
- Somewhat easy.

Not at all easy.

* How long did it take you to complete this course, posttest, and course evaluation?

60 minutes (or more) per contact hour

50-59 minutes per contact hour

40-49 minutes per contact hour

30-39 minutes per contact hour

Less than 30 minutes per contact hour

I heard about ATrain Education from:

Government or Department of Health website.

State board or professional association.

Searching the Internet.

A friend.

An advertisement.

I am a returning customer.

My employer.

Other

Social Media (FB, Twitter, LinkedIn, etc)

Please let us know your age group to help us meet your professional needs.

18 to 30

31 to 45

46+

I completed this course on:

My own or a friend's computer.

A computer at work.

A library computer.

A tablet.

A cellphone.

A paper copy of the course.

Please enter your comments or suggestions here:

License Number and State: _____

Please email my certificate: Yes No

(If you request an email certificate we will not send a copy of the certificate by US Mail.)

Payment Options (Overmedication 219)

You may pay by credit card or by check.

Fill out this section only if you are **paying by credit card**. 2 contact hours: \$19

Credit card information

* Name: _____

Address (if different from above): _____

* City: _____ * State: _____

* Zip: _____

* Card type:

Visa Master Card American Express Discover

* Card number: _____

* CVS#: _____ Expiration date: _____