



Medication Use in the Elderly Population

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Introduction

The number of elderly Americans is on a rapid rise due to the aging of the baby boom generation, and increases in life expectancy. The elderly or geriatric population is defined as those 65 years of age or older. Currently there are 36 million geriatrics in the U.S., accounting for 13% of the population.¹ This number is projected to increase significantly, with individuals over 85 years of age constituting the most rapidly growing segment of the population. It is estimated that by the year 2030, the number of persons aged 65 and older will reach 71 million.¹ This trend is not unique to the United States, as most of the developed and developing countries are experiencing similar demographic changes.

Advancement in therapeutic benefits of new medications has contributed significantly to better quality and longer life expectancy. However, longer life expectancy inadvertently results in quantitative rise of disability and chronic diseases with further risk of adverse outcomes. Naturally occurring changes in physiologic function, such as age-related decline in renal and hepatic function that alters the ability of the body to eliminate medications occurs with aging. This leads to drug accumulation in the body if dose adjustment is not made. Additionally, elderly patients are more sensitive to the effects of medications and are often not able to tolerate the usual adult dosages. This becomes even more pronounced as the patients grow older from 65-75 years ("young old") to 75-85 years ("middle old"), and finally older than 85 years ("oldest old").

The elderly consume more than one-third of the prescription and non-prescription medications used in the United States.² The average

older person uses 5.8 prescription drugs and 3.2 over-the-counter drugs.³ As the number of medications consumed increases, so does the risk of drug-related problems (DRP). DRPs are one of the biggest challenges facing the medical system.

Drug-Related Problems

While the elderly have benefited from many potent and specific drugs available for treatment of various acute and chronic illnesses, there is a growing body of evidence that suggests polypharmacy, with associated adverse drug reactions and interactions, has become a significant problem in the treatment of the elderly.

DRP can be defined as "an undesirable patient experience that involves drug therapy and that actually or potentially interferes with a desired patient outcome". In 1999, over 25% of hospital admissions for the elderly were due to DRP.⁴ These lead to increased confusion, depression, falls, disability and loss of independence. Several categories of DRPs are listed in Table 1.⁵

Adverse Drug Reactions

Inappropriate prescribing in the elderly is a widespread problem and has received much attention in recent years. In fact, avoidable adverse drug reactions (ADRs) are the most serious consequence of inappropriate prescribing. The elderly are at risk of having ADRs due to polypharmacy, noncompliance, and altered pharmacokinetics and pharmacodynamics.⁶ In 2000, between 18% and 24% of admissions of hospitalized elderly were attributable to adverse drug events.⁷

Symptoms of an ADR can be extremely subtle in an elderly patient

Table 1. Categories of Drug-related Problems⁵

CATEGORY	DEFINITION
Untreated indication	Patient has a medical problem that requires drug therapy but is not receiving medication for the indication.
Improper drug selection	Patient has a medical problem that requires drug therapy but is receiving wrong medication.
Subtherapeutic dose	Patient has a medical problem that is being treated with an inadequate dose of the correct medication.
Failure to receive drug	Patient has a medical problem that is a result of not receiving a drug (e.g., pharmaceutical, psychological, sociologic, or economic reasons).
Overdose	Patient has a medical problem that is being treated with an excessive dose of the correct medication.
Adverse drug reaction	Patient has a medical problem as the result of an unintended or detrimental adverse drug effect.
Drug interaction	Patient has a medical problem that is the result of a drug-drug, drug-food, or drug-laboratory interaction.
Drug use without indication	Patient is taking a drug without a valid medical reason.

and may be manifested by increased frequency of falls, increased confusion, excessive sedation, constipation, urinary retention, decreased oral intake, or a general failure to thrive.⁸⁻⁹ Because these problems are commonly seen in the elderly, it is not uncommon for a physician to “treat” an adverse drug effect with another drug. The risk of ADRs and symptoms such as delirium, cognitive impairment, falls and hip fractures are associated with significant morbidity and mortality.

Polypharmacy/Compliance

Polypharmacy, a phenomenon commonly seen in the elderly, is defined as the use of more medications than is clinically indicated. This is often a result of a “prescribing cascade” or prescription of medication to manage the adverse effects of another medication. Polypharmacy can lead to ADRs and drug interactions, which can further lead to falls, fractures and hospitalizations. Some of the contributing factors to polypharmacy include multiple chronic disease states, multiple health care providers, use of duplicate medications and inappropriate prescribing.⁹ Polypharmacy also leads to difficulties with compliance of medication regimens. It is estimated that between 21-55 percent of elderly are noncompliant with their drug regimen.¹⁰

Physiologic Changes in the Elderly

Age-related changes in the kidneys, liver and other organs influence the way many medications work. The elderly are of smaller physical stature than younger adults, often as a result of decreased muscle mass, and the percentage of body fat increases with a corresponding decrease in the percentage of body water. Cardiac output tends to decrease, and kidney function gradually declines. Nutritional status, multiple chronic diseases and functional and cognitive deficits are other age-related factors that may have an impact on drug therapy. These changes require a decrease in the dose of some medications to maximize the therapeutic benefits of drug therapy while avoiding toxicity and adverse reactions.

Pharmacokinetic Changes in the Elderly

Physiologic changes that occur with aging may affect the way drugs work within the body by influencing pharmacokinetic parameters: absorption, distribution, metabolism, and excretion.

Absorption

The elderly have a decreased gastric acidity and intestinal blood flow and slowing in gastric emptying time. Increased gastric pH can decrease absorption for calcium carbonate, itraconazole, ketoconazole, or any drug requiring the presence of acid for absorption. Slower gastric motility and emptying can increase the risk for ulceration for aspirin and NSAIDs and can delay onset of action of some drugs (e.g. levodopa). Natural increase in body fat and decrease in muscle mass contributes to changes in absorption of transdermal, intramuscular and subcutaneous administration. While many changes occur in the

aging gastrointestinal tract, the extent of drug absorption may not be clinically relevant.⁹⁻¹³

Distribution

Age-related physiologic changes that lead to alterations in drug distribution include: decrease in lean body mass, increase in body fat, decrease in total body water, and decrease in plasma albumin concentration. Fat-soluble drugs (e.g. benzodiazepines, phenobarbital) are widely distributed resulting in less intense drug effect due to a lower blood concentration. But the effect is prolonged because of the slow release of the drug from fatty tissue. The volume of distribution for water-soluble drugs (e.g. digoxin, lithium) is generally decreased in the elderly as total body water diminishes, resulting in higher drug concentrations in circulation. Since serum albumin levels decline with aging, higher free levels of highly-bound drugs (e.g. phenytoin) can occur, resulting in a need to lower the normal dose.⁹⁻¹³

Metabolism

Age-related decreases in liver blood flow, liver size, and enzyme activity can result in decreases in drug metabolism. The decrease in hepatic blood flow decreases the rate of metabolism of certain drugs (e.g. propranolol). The decrease in enzyme activity reduces the rate of phase I metabolism (oxidative pathway). This results in a decreased clearance of drugs such as diazepam and chlordiazepoxide, leading to excess sedation and confusion. The rate of Phase II metabolism (conjugation) is not substantially altered with age (e.g. lorazepam, temazepam).⁹⁻¹³

Elimination

The elderly have a decrease in kidney function, kidney mass, blood flow to the kidneys, and renal tubular function. Kidney function decreases as much as 50 percent by age 75. Since the elderly have a higher percentage of fat to muscle mass, using the actual serum creatinine (which is derived from muscle) is not reliable. Creatinine clearance estimation by the Cockcroft and Gault equation is a better indicator since it uses age and



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Table 2. Inappropriate Medication Use in Older Adults with Potential for Severe Adverse Outcomes¹⁷

DRUG	CATEGORY	RATIONALE
Antidepressants • Amitriptyline (Elavil) • Amitriptyline/perphenazine (Triavil) • Amitriptyline/chlordiazepoxide (Limbitrol) • Doxepin (Sinequan)	Tricyclic Antidepressant	Strong anticholinergic & sedating properties, rarely the antidepressant of choice
Amiodarone (Cordarone)	Antiarrhythmic	Associated with QT interval problems & risk of provoking torsades de pointes. Lack of efficacy in older adults.
Amphetamines & Anorexic agents	Amphetamines Anorexics	Potential for causing MI, angina, HTN & dependence. Amphetamines (excluding methylphenidate) may also cause CNS stimulant adverse effects.
Antihistamines/Anticholinergics • Chlorpheniramine (Chlor-Trimeton) • Cyproheptadine (Periactin) • Dexchlorpheniramine (Polaramine) • Diphenhydramine (Benadryl) • Hydroxyzine (Vistaril & Atarax) • Promethazine (Phenergan) • Tripelemnamine	Antihistamines Anticholinergics	Potent anticholinergic properties. Nonanticholinergic antihistamines are preferred in elderly patients when treating allergic reactions.
Antihypertensives • Guanethidine (Ismelin) • Guanadrel (Hylorel)	Antihypertensive	May cause orthostatic hypotension. Safer alternatives exist.
Antipsychotics • Thioridazine (Mellaril) • Mesoridazine (Serentil)	Antipsychotics	CNS & extrapyramidal adverse effects
Barbiturates (except Phenobarbital) except when used to control seizures	Sedative-hypnotic sedative- hypnotics	Highly addictive & cause more side effects than other
Benzodiazepines, long-acting • Chlordiazepoxide (Librium) • Chlordiazepoxide-amitriptyline (Limbitrol) • Chlordiazepoxide-clidinium (Librax) • Chlorazepate (Tranxene) • Diazepam (Valium) • Flurazepam (Dalmane) • Halazepam (Paxipam) • Quazepam (Doral)	Sedative-hypnotic Antianxiety	Extremely long half-life in elderly patients, producing prolonged sedation and increasing the risk of falls and fractures. Short & intermediate acting benzodiazepines are preferred if required
Benzodiazepines, short-acting: doses greater than: • Alprazolam (Xanax) 2mg • Lorazepam (Ativan) 3mg • Oxazepam (Serax) 60mg • Temazepam (Restoril) 15mg • Triazolam (Halcion) 0.25mg	Sedative-hypnotic Antianxiety	Total daily doses should rarely exceed the suggested maximums. Because of increased sensitivity to benzodiazepines in elderly patients, smaller doses may be effective as well as safer
Chlorpropamide (Diabinese)	Hypoglycemic (sulfonylurea)	Long half-life could cause prolonged hypoglycemia, also causes SIADH
Diphenhydramine (Benadryl)	Sedative-hypnotic Antihistamine	Potently anticholinergic -may cause confusion & sedation. Should not be used as a hypnotic. Use smallest possible dose if treating emergency allergic reactions.
Disopyramide (Norpace, Norpace CR)	Antiarrhythmic	Most potent negative inotrope can induce heart failure in the elderly. Also highly anticholinergic.
Fluoxetine (Prozac) daily	Antidepressant	Long half-life & risk of excessive CNS stimulation, sleep disturbance & increased agitation. Safer alternatives exist.
Gastrointestinal Antispasmodic • Belladonna alkaloids (Donnatal & others) • Clidinium-chlordiazepoxide (Librax) • Dicyclomine (Bentyl) • Hyoscyamine (Levsin, Levsinex) • Propantheline (ProBanthine)	Antispasmodic	Highly anticholinergic & uncertain effectiveness. Should be avoided in the elderly especially for long-term use.
Indomethacin (Indocin & Indocin SR)	NSAID	Causes the most CNS adverse effects of all the NSAIDS

Table 2 continued

Ketorolac (Toradol)	NSAID	Immediate & long-term use should be avoided since a significant number have asymptomatic GI pathologic conditions
Meperidine (Demerol) PO	Narcotic analgesic	Not an effective analgesic, may cause confusion & has many disadvantages to other narcotic drugs
Methyldopa (Aldomet) Methyldopa-hydrochlorothiazide (Aldoril)	Antihypertensive	May cause bradycardia & exacerbate depression
Methyltestosterone (Android, Virilon, & Testrad)	Androgen	Potential for prostatic hypertrophy & cardiac problems
Meprobamate (Miltown & Equanil)	Antianxiety	Highly addictive & sedating anxiolytic. Prolonged use may lead to addiction, withdraw slowly
Mineral oil	Laxative	Potential for aspiration & adverse effects. Safer alternatives available.
Muscle relaxants/antispasmodics •Carisoprodol (Soma) •Chlorzoxazone (Paraflex) •Cyclobenzaprine (Flexeril) •Metaxalone (Skelaxin) •Methocarbamol (Robaxin) •Orphenadrine (Norflex) •Oxybutynin (Ditropan) Do not consider the extended-release Ditropan XL	Muscle relaxantsAntispasmodics	Poorly tolerated leading to anticholinergic adverse effects, sedation, and weakness. Additionally, their effectiveness at doses tolerated by elderly patients is questionable.
Nifedipine (Procardia & Adalat), short acting	Antihypertensive	Potential for hypotension & constipation
Nitrofurantoin (Macrochantin)	Antibiotic	Potential for renal impairment. Safer alternatives available.
NSAID, long half-life, long term use of full dosage •Naproxen (Naprosyn, Avaprox & Aleve) •Oxaprozin (Daypro) •Piroxicam (Feldene)	NSAID (non-COX selective)	Potential to produce GI bleeding, renal failure, high blood pressure, & heart failure.
Pentazocine (Talwin)	Narcotic analgesic (mixed agonist and antagonist)	Causes more CNS adverse effects including confusion & hallucinations than other narcotics.
Stimulant laxatives, long term •Bisacodyl (Dulcolax) •Cascara Sagrada •Neoloidexcept in presence of opiate use	Stimulant laxatives	May exacerbate bowel dysfunction
Thyroid Desiccated	Thyroid hormone available.	Concerns about cardiac effects. Safer alternatives
Ticlopidine (Ticlid)	Antiplatelet	Increased hematologic adverse effects without increased efficacy over aspirin
Trimethobenzamide (Tigan)	Antiemetic	One of the least effective antiemetics & can cause extrapyramidal adverse effects.

ideal body weight as a factor in assessing renal function. Due to decrease in kidney function in the elderly, dose reduction of drugs that are eliminated by the kidneys is often needed.⁹⁻¹³

Pharmacodynamic Changes in the Elderly

The elderly are more sensitive to the actions of certain drugs due to changes at the receptor level, which includes changes in receptor binding, a decrease in the number of receptors, and altered biochemical reactions initiated by receptors. In general, the elderly are more sensitive to medications acting on the central nervous system—commonly leading to sedation, dizziness, and confusion. Sympathetic and parasympathetic response is impaired due to changes in receptor function. This fact likely explains the orthostatic hypotension commonly seen in the elderly. In addition, age-related decrease in response to cholinergic receptors affects anticholinergic drug response (e.g. urinary retention).⁹⁻¹³

Inappropriate Medications

Inappropriate use of medications in the elderly can increase the risk of complications, manifested as serious drug-related morbidity or mortality. Although all medications have some risk of causing adverse effects, some medications have been identified as having a considerably

higher potential to cause problems when prescribed to elderly patients. Some studies indicate that 14 to 24 percent of the elderly receive at least one potentially inappropriate medication.¹⁴⁻¹⁵ A list of potentially inappropriate medication use by the elderly was developed based on a survey of a panel of nationally recognized leaders in geriatric care, which is known as Beers' criteria.¹⁶ It specifies medications that should generally be avoided in the elderly, doses that should not be exceeded and medications that should be avoided in elderly patients with certain co-morbidities. These recommendations were updated by a consensus panel of experts in December 2003.¹⁷ Inappropriate medication use in nursing home residents is believed to be prevalent. Therefore, the Health Care Financing Administration adopted the published lists as guidelines for surveyors of long-term care institutions.¹⁸ Table 2 lists potentially inappropriate medications with severe complications in the elderly. Table 3 lists medications associated with less severe complications in the elderly, and table 4 lists medications that should be avoided considering diagnoses or conditions.¹⁷

Anticholinergic Drugs

Drugs with marked anticholinergic adverse effects make up much of the Beers' criteria list, and include: tricyclic antidepressants (e.g.

Table 3. Inappropriate Medication Use in Older Adults with Potential for Less Severe Adverse Outcomes¹⁷

Clonidine (Catapres)	Antihypertensive	Potential for orthostatic hypotension & CNS adverse effects
Cimetidine (Tagamet)	H ₂ blocker	CNS Adverse effects including confusion
Digoxin (Lanoxin) should not exceed >0.125mg/d except when treating atrial arrhythmias)	Cardiac drug	Decreased renal clearance may lead to increased risk of toxic effects
Dipyridamole (Persantine), short acting. Do not consider the long-acting dipyridamole (which has better properties than the short-acting in older adults) except with patients with artificial heart valves	Antiplatelet	May cause orthostatic hypotension
Doxazosin (Cardura)	Alpha-adrenergic blocker	Potential for hypotension, dry mouth, and urinary problems
Ergoloid Mesylates (Hydergine) Cyclandelate (Cyclospasmol)	Vasodilator	Have not been shown to be effective in the doses studied
Estrogens only (oral)	Estrogens	Evidence of the carcinogenic (breast & endometrial cancer) potential of these agents & lack of cardioprotective effect in older women.
Ethacrynic acid (Edecrin)	Diuretic	Potential for hypertension & fluid imbalances. Safer alternatives available.
Ferrous sulfate >325mg/d	Iron	Doses >325mg/d do not dramatically increase the amount absorbed but greatly increase the incidence of constipation.
Isoxsuprine (Vasodilan)	Vasodilator	Lack of efficacy
Propoxyphene (Darvon) & combination products (Darvon with ASA, Darvon-N & Darvocet-N)	Narcotic analgesic	Offers few analgesic advantages over acetaminophen, yet has the adverse effects of other narcotic drugs.
Reserpine at doses >0.25mg	Antihypertensive	May induce depression, impotence, sedation, and orthostatic hypotension.

amitriptyline), muscle relaxants/antispasmodics (e.g. cyclobenzaprine, oxybutynin, dicyclomine, belladonna alkaloids), and older antihistamines (e.g. diphenhydramine).¹⁷ Anticholinergic side effects include constipation, dry mouth, urinary retention, and increased heart rate (tachycardia). However, side effects also include sedation, confusion, blurred vision, agitation, and nervousness that may erroneously be attributed to the aging process rather than to these adverse effects. Constipation, urinary retention, dry mouth, and impaired or changed eating habits may similarly confound observations of adverse effects. Thus, the elderly should avoid most medications with anticholinergic activity.¹⁹

Tricyclic Antidepressants

All tricyclic antidepressants (TCAs) produce various degrees of anticholinergic activity and frequently cause problems in the elderly. The tertiary amines including amitriptyline, imipramine, and doxepin produce a greater amount of anticholinergic activity than the secondary amines (nortriptyline and desipramine), which are the preferred TCA agents for the elderly. The most serious complication from TCAs is cardiac toxicity (arrhythmias), which most often occurs in persons with pre-existing cardiac disease.^{14,17,19,20}

Another potentially serious adverse effect from TCAs is orthostatic hypotension, caused by the alpha 1 adrenoceptor antagonist activity of TCAs, increasing the risk of falls and fractures in the elderly. TCAs can also cause CNS effects such as confusion and seizures. One indication that remains for use of TCAs is the treatment of neuropathic pain; generally the doses are much lower than those used for treating depression.²⁰

Antipsychotic Medications

Adverse effects of antipsychotic medications include anticholinergic effects and extrapyramidal symptoms (bradykinesia, stiffness,

cogwheel rigidity, akinesia, and akathisia). Extrapyramidal symptoms are more common in elderly patients and continue for longer periods, once the antipsychotic medication has been discontinued. Tardive dyskinesia also can occur and is more common in the elderly after even a relatively brief exposure to these drugs. Other common adverse effects include excessive sedation, orthostatic hypotension, increased risk of falls and hip fractures, and potential for cardiac arrhythmias.^{14,17,19-20}

Benzodiazepines

Benzodiazepines (BZDs) are a prime example of medications that require adjustment in the elderly. BZDs can produce ataxia, confusion, imbalance, immobility, limited reaction time, and sedation. Secondary to several of these effects is an increased risk of falls and fractures. Benzodiazepines are categorized according to half-life and the presence or absence of active metabolites. The older BZDs (diazepam, chlordiazepoxide, flurazepam) are highly lipid-soluble. Low lipid-soluble BZDs (lorazepam and oxazepam) have short half-lives and much less risk for accumulation. Problems reported with BZDs use in the elderly include dependence, cognitive impairment and increased risk of falls. When BZDs are indicated for use in the elderly, those drugs with low lipid solubility and without active metabolites should be used in low doses, and only for short-term use when possible.^{14,17,19-20}

Antihistamines

Older antihistamines such as diphenhydramine are the most common agents that present risk for the elderly population. Diphenhydramine is frequently used for insomnia, upper respiratory tract infection, or allergies. This drug crosses the blood-brain barrier, causing CNS adverse effects such as sedation, cognitive impairment and delirium in older patients.

Table 4. Beers' Criteria Considering Diagnoses or Conditions¹⁷

Arrhythmias	Tricyclic antidepressants (imipramine, doxepin, amitriptyline)	Concern due to proarrhythmic effects and ability to produce QT interval changes.
Anorexia & malnutrition	CNS stimulants: DextroAmphetamine, methylphenidate, methamphetamine, pemolin and fluoxetine	Concern due to appetite-suppressing effects.
Bladder outflow obstruction	Anticholinergics, antihistamines, gastrointestinal antispasmodics, muscle relaxants, oxybutynin, flavoxate, antidepressants, decongestants, and tolterodine	May decrease urinary flow, leading to urinary retention.
Blood clotting disorders or receiving anticoagulant therapy	Aspirin, NSAIDs, dipyridamole, ticlopidine and clopidogrel	May prolong clotting time & elevate INR or inhibit platelet aggregation, resulting in an increased potential for bleeding.
Chronic constipation (low severity)	Calcium channel blockers, anticholinergics and tricyclic antidepressant (imipramine, doxepin, amitriptyline)	May exacerbate constipation.
Cognitive impairment	Barbiturates, anticholinergics, antispasmodics, muscle relaxants, CNS stimulants (dextroamphetamine, methylphenidate, methamphetamine and pemolin)	Concern due to CNS-altering effects.
COPD	Long-acting benzodiazepines (chlordiazepoxide, chlordiazepoxide-amitriptyline, clidinium-chlordiazepoxide, diazepam, quazepam, halazepam, chlorazepate), B-blockers(propranolol)	CNS adverse effects. May induce respiratory depression. May exacerbate or cause respiratory depression.
Depression	Long-term benzodiazepine use. Sympatholytic agents (methyl dopa, reserpine, and guanethidiene)	May produce or exacerbate depression.
Gastric or duodenal ulcers	NSAIDs and aspirin (>325mg) (coxibs excluded)	May exacerbate existing ulcers or produce new/ additional ulcers.
Heart failure	Disopyramide, high sodium content drugs (sodium & sodium salts[alginate bicarbonate, biphosphate, citrate, phosphate, salicylate, and sulfate])	Negative inotropic effect. Potential to promote fluid retention and exacerbation of heart failure.
Hypertension	Pseudoephedrine, diet pills, and amphetamines	May produce elevation of blood pressure secondary to sympathomimetic activity.
Insomnia	Decongestants, theophylline, methylphenidate, MAOIs, and amphetamines	Concern due to CNS stimulant effects.
Obesity (low severity)	Olanzapine	May stimulate appetite and increase weight gain.
Parkinson disease	Metoclopramide, conventional antipsychotics, and tacrine	Concern due to their antidopaminergic/cholinergic effects.
Seizure disorder, or epilepsy	Bupropion Clozapine, chlorpromazine, thioridazine, and thiothixene	May lower seizure threshold.
SIADH/hyponatremia(low severity)	SSRIs (fluoxetine, citalopram, fluvoxamine, paroxetine, and sertraline)	May exacerbate or cause SIADH.
Stress incontinence	Alpha-blockers (doxazosin, prazosin, terazosin), anticholinergics, tricyclic antidepressants, long-acting benzodiazepines	May produce polyuria and worsening of incontinence.
Syncope or Falls	Short to intermediate acting benzodiazepine and tricyclic antidepressants	May produce ataxia, impaired psychomotor function, syncope, and additional falls.

These effects increase the risk of falls and fractures in the elderly. The anticholinergic properties of older antihistamines produce effects such as dry mouth, constipation, blurred vision, and drowsiness.^{17,19-20}

Underutilization of Drugs

While there are drugs to avoid in the elderly, there are drugs that are beneficial in the treatment or prevention of serious diseases that may not be prescribed to older adults. Underutilization of drugs in the elderly occurs with angiotensin-converting enzyme (ACE) inhibitors, aspirin, Beta-blockers, HMG CoA reductase inhibitors (Statins), thrombolytics, warfarin, antidepressants, iron, stool softeners, and pain medications.^{10,21-22} ACE inhibitors reduce mortality in patients with congestive heart failure, but are only prescribed to a minority of

elderly hypertensive patients with this condition. Aspirin and beta-blockers can prevent recurrent cardiac events in patients with myocardial infarction, but frequently are omitted from the regimens of elderly patients. Statin drugs appear to work as well in elderly patients as they do in younger patients and reduce the risk of both stroke and MI in this age group, but are underused. Despite the overuse of selective serotonin reuptake inhibitors for those unlikely to benefit, elderly patients are still not diagnosed and adequately treated for depression.

Conclusion

The physiological changes of aging along with the disease burden facing older people complicate prescribing of medication to the elderly. The information regarding drug utilization, polypharmacy,



appropriateness, and adherence in the elderly is critically important. The effects of aging, as related to drug therapy, illustrate the challenges in selecting proper medications for the elderly. Conservative dosing, starting low and going slow, and close clinical monitoring is critical and should be emphasized by all health care practitioners caring for the elderly. The use of inappropriate medications in the elderly is an important issue because of the increased vulnerability of this segment of the population. Medications should be prescribed only for appropriate reasons, discontinued when they no longer offer therapeutic benefit, and dosed correctly to reflect alterations in age-related pharmacokinetics and pharmacodynamics. Once appropriate medication therapy is implemented, pharmacists should monitor individuals to ensure that patients receive therapeutic benefits and avoid adverse drug reactions.

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The Alternative To A Traditional Career In Pharmacy

Career n.
an occupation undertaken for a significant period of a person's life, usually with opportunities for progress.

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- Special Clients, Flexible Assignments
- A Variety Of Bonus Programs
- Professional Development Opportunities/Cross Training

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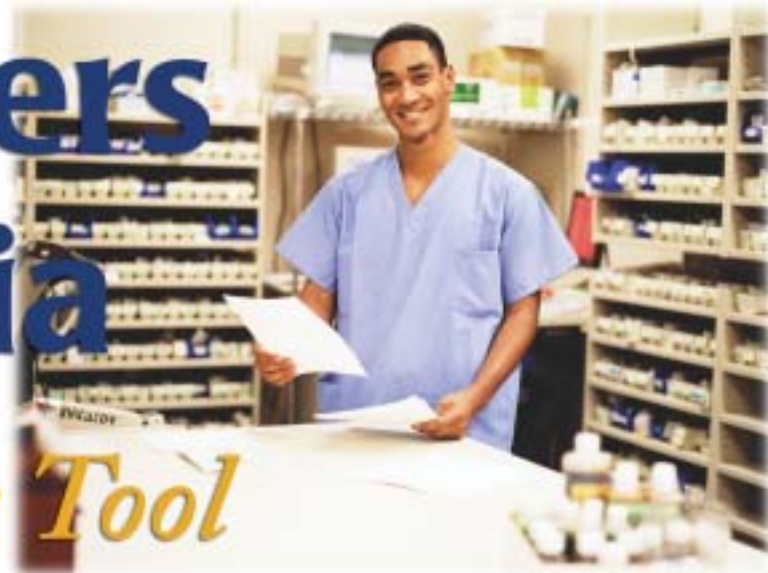
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The Beers Criteria

A Quality Tool



by Christina Phan, PharmD and Craig Stern, PharmD, MBA
(Beers Criteria listed on page 49)

For a decade or more there has been a concern regarding the quality of medication therapy provided to the elderly population. There is now ample evidence to support this concern. Elderly patients in the United States consume at least a third of all prescribed medications. Nursing home residents use at least six medications and 20% of them use at least 10 medications. Statistics show that thirty percent of hospital admissions in elderly patients are attributed to adverse drug events (ADE) or drug toxicity. Gurwitz et al. estimated 1.89 ADEs per 100 resident-months, and at least one-half were identified as preventable. Bond et al. quoted an overall incidence of adverse drug reactions (ADR) in hospitalized Medicare patients of 6.7% (range 1.2 – 24%) and 0.32% for fatal ADRs. The resulting cost estimates are \$1.56 to \$4B/year. Regrettably, fatal ADRs rank fourth to sixth in leading causes of death.

ADEs not only contribute to increased health care costs, but also to a reduction in quality of life.² A measure of the quality of medication therapy needs to be used in order to evaluate the safety of a prescriber's or institution's medication prescribing. Since its formulation in 1991, the Beers criteria have been used by many institutions including the Center for Medicare and Medicaid Services (CMS) as a standard for determining the quality of medication therapy for the elderly.⁴

What is the Beers list?

The Beers Criteria was formulated in 1991 in response to a need for explicit criteria to evaluate the medications administered to nursing home patients older than 65 years of age. The list was determined by group consensus after review of current literature. The evaluating body consisted of nationally recognized experts in clinical geriatric care, geriatric pharmacology and psycho-pharmacology. The original criteria included a list of medications or medication classes that should generally be avoided in nursing home residents older than 65 years of age, because of their high risk or adverse effects. The list also included doses, frequencies or durations of therapies that were appropriate for use in the elderly.¹ In 1997 the criteria were updated to include

new medications and new information regarding side effects. In addition, the investigators included a severity rating scale as well as a list of medications that were inappropriate for those with specific medical conditions. Finally, the criteria were adjusted so that they could be applied in general to the elderly population and not specifically to those older than 65 years of age residing in nursing homes.³ The most recent update of the criteria occurred in 2003 when the panel of experts reevaluated the 1997 criteria, considered the inclusion of newer medications, incorporated updated information, reevaluated the severity ratings and identified new medication conditions that were not considered in the 1997 criteria.⁴

What was the motivation for the list?

In response to the increased utilization of medications in the geriatric community, and the increased risks of drug-related adverse drug reactions and hospitalizations, the Beer's list was created in order to identify potentially inappropriate medications. The geriatric population is specifically at risk for ADEs because of the age-associated changes in the functions of various organs that may affect the pharmacokinetics and pharmacodynamics of many drugs.⁹ Chan et al. showed that 30% of hospital admissions of elderly patients were attributed to an adverse drug event and that 53.4% of these admissions could have been prevented.¹⁴ The incidence of adverse drug events in the ambulatory setting has been reported to be 50.1 events per 1000 patients per year; 13.8 of these events were preventable. Of these adverse drug events, 38% were defined as serious, life-threatening or fatal; 42.2% of these events were preventable.¹⁵ Due to the high prevalence of drug-related ADE and hospitalizations, a quality tool to assess inappropriate drug use was needed.

How is the list used in various healthcare settings?

The Beer's list has been acknowledged to be a useful guide in assessing the appropriateness of drug prescribing in the elderly. One

study utilized the Beer's criteria in the development of a list of potential medication problems which was then applied to a model for improving medication use in home health care patents. Their model for problem assessment and resolution was based on the use of the guidelines by the drug utilization review coordinator and the attending home health care nurse. The DUR coordinator uses the guidelines to identify potential medication problems and then works with the home health nurse and physician to assess the situation.¹⁶ Many groups, including the Hartford Institute for Geriatric Nursing, have suggested in their "best practice guidelines" that the Beers criteria be used to identify medications that may increase risk for ADR.¹⁷ In addition, the American Pharmacist Association's Medication Therapy Management Services Outcomes Measurement Task Force has suggested the use of the Beer's criteria as a process measure to determine the appropriate use of medications, insure adherence to guidelines and evaluate the quality of care.

What are the clinical arguments for applying the

The usefulness of the Beer's Criteria in predicting adverse drug reactions and increases in costs and resource utilization has been demonstrated through various studies. Chang et.al found a positive association between potentially inappropriate medications as described by the Beer's Criteria and adverse drug reactions in first-visit elderly outpatients.¹⁸ In the population that was studied they found that 11.6% had been prescribed an inappropriate medication and that 22.9% had an adverse drug reaction. Another study involving the impact of potentially inappropriate medications in a Medicare managed care population showed that a high prevalence of potentially inappropriate medications (24.4%) among the elderly that was associated with higher costs and higher mean numbers of inpatient visits, ER visits, office visits, outpatient visits and higher mean total facility, provider and prescription costs.⁵

CMS has incorporated the use of the Beers criteria into its *Guidelines to Surveyors of Long Term Care Facilitators*. The guidelines list medications that may potentially cause adverse reactions, reasons for their inclusion on the list, adverse reactions associated with the medication and possible exceptions allowing the use of a potentially inappropriate medication. Failure of an institution to comply with these guidelines may result in a federal deficiency (F-tag) citation. (Note: The F-tag 329 refers to a nursing home resident's "right to be free from unnecessary drugs."¹⁹⁻²⁰

What are the clinical arguments against using the list?

Despite the popularity of the Beers criteria, there has been criticism regarding its predictive value. The Duke Cohort study analyzed the relationship between inappropriate drug use as defined by the Beers criteria, and mortality in community dwelling elders as well as the effects of inappropriate drug use and the decline in functional status. The study found that 28% of the population had used one or more inappropriate medications and that half of the users were taking a drug classified as high severity. By the end of the three year study, 17% of the population had died; however there was no significant association between the use of inappropriate medications and mortality, or decline in functional status.⁸

What is the current experience with its use?

Most studies utilize the Beers criteria as a tool for determining the prevalence of inappropriate drug prescribing and to evaluate the quality of care provided to patients. The use of the criteria has expanded beyond the nursing home setting to include skilled nursing facilities, board and care facilities, office-based physicians, as well as community-dwelling adults.^{2,8-13} All of the studies conducted in the various settings found a high prevalence of inappropriate medication use in the elderly population, which may in turn suggest poor quality

of care. However, many of these studies did not analyze the direct consequences of inappropriate drug use.

Chang et.al studied the list in first-visits of elderly outpatients to outpatient clinics associated with tertiary care academic medical centers in Taiwan. They identified a positive association between the list and ADRs in patients taking five or more medications, a history of ADRs, or poor compliance.¹⁸

What are the limitations on their use?

The Beers criteria have several limitations. Since the criteria were created based on the opinions of an expert panel, they are not evidence-based, and therefore, may not be applicable to every situation. The American Medical Directors Association and the American Society of Consultant Pharmacists issued a joint position statement on the Beers List expressing their concerns that because the list was not created based on an evidence-based methodology, it should only be used as a "helpful general guide" to identify potentially inappropriate medication use in the elderly. They stress that that the ultimate decision for the use of a medication should be clinically based.²⁰ The general applicability of the criteria is also questionable because the updated 2003 criteria are meant to apply to the general population of adults 65 years and older and may not apply to significantly older individuals or those with complex disease states.⁴ Also, the criteria are based on current information and opinions at the time of their creation and thus, will need to be periodically updated to include new information and scientific information.¹

The Beers list is limited and thus does not contain all medications that may be inappropriate. Medications that are not on the list may still be inappropriate for elderly patients. Furthermore, medications that are on the list may still be an appropriate therapeutic option as long as the patient is closely monitored and the dosing regimen is adjusted for each individual patient.⁶

What are the lessons for pharmacists?

The Beers criteria serve as a useful quality tool for identifying potentially inappropriate medications. However, they should only be used as a general guideline to alert pharmacists and other health professionals of potential adverse reactions and should not be used as an absolute indicator of adverse events. In addition to the criteria, pharmacists must evaluate and address the needs of the individual patients. It is important that pharmacists apply both clinical knowledge and evidence based medicine in formulating their therapeutic decisions. Ultimately, the Beers criteria should not be used as a replacement for, or independent of, a clinician's judgment. Rather, the Beers criteria should be used in conjunction with the knowledge and experience of a health professional, taking the individual needs of a patient into account.

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