

CME/CPE ARTICLE

Prescribing Medications for Geriatric Patients in the Managed Care Setting

Adam G. Golden, MD; Michael A. Silverman, MD; and Richard A. Preston, MD, MBA

ACCREDITATION

This article is dually accredited for continuing medical or pharmacy education.

AUDIENCE

This article is intended for all clinicians and pharmacists involved in prescribing medications to elderly patients.

GOAL

To provide the reader with a basic understanding of the complicated issues associated with prescribing medications to older adults, focusing on the implications for managed care systems.

OBJECTIVES

1. Discuss the issues of polypharmacy, noncompliance, and "underprescribing."
2. Discuss the contributing factors and medications associated with adverse drug reactions in the elderly.
3. Discuss the issues associated with the development of criteria for inappropriate medication prescribing in the elderly.
4. Review the current literature regarding measures to improve geriatric medication prescribing.

CONTINUING MEDICAL EDUCATION ACCREDITATION

Johns Hopkins University School of Medicine designates this continuing medical education activity for 1 credit in Category 1 of the Physician's Recognition Award of the American Medical Association.

Johns Hopkins University School of Medicine is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to sponsor continuing medical education for physicians.

This activity was planned and produced in accordance with the ACCME Essentials.



CONTINUING PHARMACY EDUCATION CREDIT

This course has been approved for one (1) contact hour of continuing education credit (0.1 CEU) by the University of Tennessee College of Pharmacy. The University of Tennessee College of Pharmacy is approved by the American Council on Pharmaceutical Education as a provider of continuing pharmaceutical education. ACPE Program Number: 064-000-00-204-H-O1. This course expires on May 31, 2003.

The elderly population (aged 65 years and older) currently accounts for 12% of the US population but consumes more than 25% of all prescription medications.¹ The elderly individual uses an average of 4.8 prescription and nonprescription medications daily.² Altered pharmacokinetics/pharmacodynamics, polypharmacy, and noncompliance are important risk factors for adverse drug reactions (ADRs) that continue to confront physicians and clinical pharmacists caring for older adults. On the other hand, many beneficial medications are "underprescribed" in older adult patients. Because many managed care organizations (MCOs) offer either prescription drug coverage or discounted options through pharmacy benefits managers, these issues are also of great importance to the delivery of care and the financial performance of the MCO.

Issues for Medication Prescribing in the Elderly

Altered Pharmacokinetics and Pharmacodynamics. Pharmacokinetic and pharmacodynamic changes may place the older adult patient at increased risk for adverse effects. Pharmacokinetic changes are well described and are listed in Table 1.¹ There is more physiologic heterogeneity among older than younger individuals, and it is therefore difficult to predict which pharmacokinetic changes will be clinically relevant in an individual geriatric patient. Regarding gastric acid secretion, a recent study by Hurwitz et al³ shows that baseline and stimulated gastric acidity are unchanged in the elderly.

From the Division of Gerontology and Geriatric Medicine, Department of Medicine (AGG, MAS), and the Division of Clinical Pharmacology, Department of Medicine (RAP), University of Miami School of Medicine, Miami, FL; Miami Geriatric Research, Education, and Clinical Center, Miami, FL (AGG, MAS); Stein Gerontological Institute, Miami, FL (MAS); and Eldercare, Miami, FL (MAS).

Address correspondence to: Adam G. Golden, MD, GRECC (11-GRC), Veterans Affairs Medical Center, 1201 NW 16th Street, Miami, FL 33125. E-mail: goldengeriatrics@hotmail.com.

Altered pharmacodynamics (difference in drug effect for a given serum drug level) may compound the other factors detailed in this review. Unfortunately, there has been little research studying the pharmacodynamics of specific medications in elderly patients.

Polypharmacy. Polypharmacy can be operationally defined as “a drug regimen containing 1 medication more than the patient needs.”⁴ Several interrelated factors often contribute to the problem of polypharmacy in the elderly. Elderly patients generally have more medical illnesses than younger patients. Many older adults have their care provided by multiple physicians who may be unaware of the medications prescribed by the other healthcare providers. In addition, geriatric patients often actively engage in practices that contribute to their polypharmacy, including medication sharing among patients and “doctor shopping,” ie, actively seeking the services of new physicians to obtain specific medications or treatments.⁴ With many pharmaceutical companies directly marketing their medications to consumers, the occurrence of doctor shopping may be increasing. In MCOs, access to medical specialists is coordinated through a primary care provider. Whether this control of resource utilization has had an impact on the issue of polypharmacy in the managed care setting needs further study.

In addition to high use of prescription medications, use of nonprescription medications is 7-fold higher in the geriatric population.⁵ It is important that healthcare providers ask their geriatric patients about use of nonprescription medications and alternative medicine products because these medications may be associated with potential adverse effects and harmful interactions with prescription medications.

Polypharmacy is a significant risk factor for ADRs and failed patient compliance. Several studies⁶⁻⁸ have also shown that polypharmacy increases healthcare costs through the direct costs of the medications and through the indirect costs resulting from increased visits to healthcare providers and from the treatment of ADRs. As medication costs continue to rise for the MCO and many physician groups begin to assume financial risk for pharmacy benefits, the need to address this issue becomes ever more important.

Noncompliance. Noncompliance can be defined as the inability to use a medication as prescribed,⁴ and it is an important contributor to treatment failure. Medication noncompliance is a difficult prob-

lem that affects approximately 60% of the elderly population.⁹ Although the term noncompliance is often associated with failure to take a prescribed medication, it can also refer to overuse of a particular medication. Misuse of common medications in the elderly, such as insulin and diuretics, can lead to serious illness if the dose taken is too small or too large.

In addition to polypharmacy, other problems, such as medication adverse effects¹⁰ and complex dosing schedules, also decrease drug compliance. Inadequate physician-patient communication regarding the disease process and the need for medication is especially common in elderly patients with sensory (vision and hearing) impairment and cognitive dysfunction. For the elderly person with limited income, the cost of medicine may prohibit its use (currently, Medicare does not pay for outpatient medications). Managed care plans that offer prescription drug benefits may appeal to older adults facing high medication-related expenses.

Table 1. Possible Pharmacokinetic Alterations and Their Associated Physiologic Changes in Elderly Patients

Pharmacokinetic Alteration	Physiologic Changes
■ Absorption	Decreased number of absorptive cells Unchanged gastric acidity Decreased splanchnic blood flow Decreased gastric motility and gastric emptying
■ Distribution	Increased fat-muscle ratio Decreased total body water level Decreased plasma albumin level*
■ Clearance	
Renal	Decreased renal blood flow Decreased renal mass Decreased glomerular filtration rate
Hepatic	Decreased liver blood flow Decreased enzyme activity (oxidation) Unchanged hepatic conjugation

*Associated with several chronic diseases (cirrhosis, malnutrition, renal failure, and nephrotic syndrome).

However, more than 90 health maintenance organizations (HMOs) in the United States have discontinued providing benefits to the elderly population because it was believed that extending care to these patients is no longer profitable.¹¹ In addition, 82% of Medicare risk plans have a cap on pharmacy benefits, and many are increasing patient copayments. The effect of increases in prescription copayments on drug utilization for older patients is unclear.¹²

To increase compliance in the geriatric population, a list of suggestions is provided in Table 2. It is important for both healthcare providers and pharmacists to be proactive in promoting open-ended communication to identify the specific issues preventing proper medication use.¹³

Geriatric Underprescribing. Whereas considerable attention has focused on the high number and expense of medications, many beneficial medications are often underprescribed in the older adult population. Evidence-based studies have shown that many medications are beneficial for the secondary prevention of diseases such as coronary artery disease, congestive heart failure, diabetes, and osteoporosis. Concern continues to grow that many of these medications are underprescribed in the elderly population.¹⁴ In the management of unstable angina, studies have shown that elderly patients are less likely to receive aspirin and β -adrenergic blocking agents despite the lack of a contraindication.^{15,16} Following a myocardial infarction, 50% of elderly patients were not prescribed β -adrenergic blocking agents¹⁷ and 24% did not

receive aspirin.¹⁸ Similarly, hypertension is often inadequately treated in the older adult population.¹⁹ Failure to treat elderly patients with angiotensin-converting enzyme inhibitors is unfortunately well described and is associated with increased mortality.²⁰⁻²²

Regarding hormone replacement therapy and osteoporosis, Handa et al²³ reported that only 6.1% of 2602 elderly women were receiving estrogen replacement therapy. Other documented examples of geriatric underprescribing are inadequate opioid analgesia for cancer pain¹⁴ and the inadequate treatment of depression in the elderly.²⁴

It is unclear whether this underprescribing is caused by a lack of education concerning current treatment guidelines in the elderly, a lack of financial resources by older patients to pay for these medications, or a reluctance on the part of physicians to do anything that may destabilize a frail older patient. This may also reflect a concern on the part of physicians not to prescribe "too many" medications that they perceive to increase the risk of ADRs. Evidence for the latter was shown by Redelmeir et al,²⁵ who noted that for elderly patients with multiple chronic medical illnesses who were recently treated for an acute illness, unrelated disorders are undertreated.

...ADVERSE DRUG REACTIONS ...

The issues discussed in the previous section may all contribute to the problem of ADRs in the elderly. An ADR can be defined as "a detrimental response in association with a given medication that is undesired, unintended, or unexpected in recognized doses."²⁶ Adverse drug reactions are a common, yet poorly studied, cause of iatrogenic illness in the geriatric population. Three percent to 10% of all hospital admissions in the elderly may be because of ADRs.¹⁰ Adverse drug reactions have also been shown to increase the risk of mortality and nursing home placement in the geriatric population.^{8,27,28} Criteria used to define an ADR may vary, but common ADRs are listed in Table 3.

Table 2. General Prescribing Principles to Increase Geriatric Medication Compliance

- | |
|---|
| <ul style="list-style-type: none"> ■ Limit medications to only those that are absolutely essential for a documented acute or chronic medical condition ■ Regularly review drugs for adverse reactions and to see if the patient still needs the medication ■ Simplify dosing regimen (once-a-day regimens preferred) ■ Reinforce education regarding medication and disease processes to patient and caregivers ■ Enlist the aid of home health personnel ■ Use assistive devices (pill boxes and drug calendars) ■ Identify communication barriers (hearing impairment, visual deficit, and cognitive dysfunction) ■ Use generic and less expensive medication choices whenever possible ■ Always start new medications at low doses and increase the dosage slowly ■ Provide written instructions to patients in large print ■ Dispense medications in easy-to-open containers |
|---|

Geriatric patients may be predisposed to ADRs for a variety of reasons. Age- and disease-related changes in pharmacokinetics and pharmacodynamics may result in harmful adverse effects from the medications themselves and from complex, yet poorly studied, drug-drug interactions. Nolan and O'Malley²⁹ noted that age, when controlling for other variables, is not a risk factor for ADRs. The presence of multiple medical illnesses is an important risk factor for the development of an ADR for 2 reasons: (1) medical illnesses often deplete a patient's physiologic reserve, and (2) the presence of multiple diseases often correlates with the use of higher numbers of medications.²⁷⁻²⁹ In patients older than 80 years, 25% will have an ADR during a hospitalization.³⁰ Furthermore, a large percentage of geriatric patients have a combination of cognitive impairment secondary to dementia and functional impairment owing to strokes, rheumatologic disease, or poor cardiopulmonary reserve. In these patients, the signs and symptoms of comorbid illnesses may mask the presentation of an ADR, leading to a possible underestimation of incidence. Even when an ADR is strongly suspected in the elderly patient, it is often difficult to determine which medication is responsible.

Because of these issues, frail elderly patients (the patients at highest risk for ADRs) are often excluded from clinical drug trials. Few medications have been adequately studied in the elderly, and there are few data on specific drug-drug interactions in the elderly. In addition, most clinical drug trials do not have the follow-up needed to detect ADRs resulting from long-term use of medications.³¹ As new drugs become available, little is known about the types of drugs involved in ADRs in the frail elderly.

...MEASURES TO IMPROVE GERIATRIC
MEDICATION PRESCRIBING ...

In addition to limiting the absolute number of medications, considerable attention has focused on proactive measures to improve the quality of medication prescriptions given to elderly patients. The goal of such measures is to limit medications with potential adverse effects and those for which safer, cheaper, or more effective alternatives exist. Several distinct avenues that experts have used to improve prescribing practices among practitioners who care for elderly patients are described in the following subsections.

Table 3. Common Presentations of Adverse Drug Reactions in Elderly Patients

<ul style="list-style-type: none"> ■ Delirium ■ Orthostatic hypotension ■ Falls ■ Electrolyte imbalances ■ Urinary incontinence ■ Constipation/fecal impaction ■ Gastrointestinal tract bleeding

Table 4. Inappropriate Medications in the Elderly (Independent of Diagnosis)

<ul style="list-style-type: none"> ■ Propoxyphene ■ Indomethacin ■ Phenylbutazone ■ Pentazocine ■ Trimethobenzamide ■ Methocarbamol, carisoprodol, oxybutynin, chlorzoxazone, metaxalone, cyclobenzaprine ■ Flurazepam ■ Amitriptyline ■ Doxepin ■ Meprobamate ■ Lorazepam (3 mg*), oxazepam (60 mg*), alprazolam (2 mg*), temazepam (15 mg*), zolpidem (5 mg*), triazolam (0.25 mg*) ■ Chlordiazepoxide, diazepam ■ Disopyramide ■ Digoxin (0.125 mg daily[†]) ■ Dipyridamole ■ Methyl dopa ■ Reserpine ■ Chlorpropamide ■ Dicyclomine, hyoscyamine, propantheline, belladonna alkaloids ■ Chlorpheniramine, diphenhydramine, hydroxyzine, cyproheptadine, promethazine, tripeleminamine, dexchlorpheniramine ■ Ergot mesyloids ■ Iron supplements (>325 mg) ■ All barbiturates except phenobarbital ■ Meperidine ■ Ticlopidine

Adapted from reference 38.

*Recommended dosing limitations.

[†]Higher doses may be used in treating elderly patients with atrial arrhythmias.

Development of Explicit Criteria for Inappropriate Medication Use

In 1991, a panel of nationally recognized leaders in geriatric care developed criteria for identifying inappropriate medications in the elderly.^{2,32} Modified versions of these criteria were used to demonstrate that the prevalence of inappropriate drug prescription in elderly patients is 12% to 40% in nursing homes^{32,33} and 14% to 23% in ambulatory patients.^{2,34} In a recent study of homebound patients enrolled in an MCO, the prevalence was noted to be 40%.³⁵ Inappropriate prescribing has been shown to be responsible for many ADRs in the frail elderly.^{36,37}

In 1997, revised criteria were developed to address which medications are inappropriate in the

general geriatric population. Beers³⁸ developed the criteria through the use of a modified Delphi consensus technique. The result of this process was 2 lists of inappropriate medications: those that are inappropriate for all elderly patients regardless of diagnosis (Table 4) and those that are inappropriate depending on the patient's specific diagnosis (Table 5).³⁸

Long-acting benzodiazepines (flurazepam, chlor-diazepoxide, and diazepam) and excessive doses of shorter-acting benzodiazepines are listed in Table 4 because they are associated with cognitive impairment, physical dependence, falls, and hip fractures.³⁸⁻⁴¹

Table 4 also includes medications with anti-cholinergic adverse effects of confusion, blurred vision, urinary retention, and constipation.^{42,43} An excessive rate of anti-cholinergic adverse effects is the principal reason that first-generation antihistamines (diphenhydramine, cyproheptadine, hydroxyzine, chlorpheniramine, promethazine, tripelemnamine, and dexchlorpheniramine), gastrointestinal tract antispasmodics (dicyclomine, hyoscyamine, propantheline, and belladonna alkaloids), muscle relaxants (methocarbamol, carisoprodol, and oxybutynin), and tertiary amines (doxepin and amitriptyline) are considered inappropriate independent of diagnosis.

The consensus criteria by Beers³⁸ were developed with the general geriatric population in mind. Therefore, the criteria were intended to apply to the active, ambulatory, community-dwelling patient as well as the homebound or nursing home resident. Failure to recognize this marked heterogeneity in the geriatric population is important because the large frail and/or institutionalized elderly population may be at a higher risk for ADRs than ambulatory, community-dwelling older adults.

Use of this concise consensus criteria may be appealing to MCOs and pharmacy benefits managers looking to address the issues of polypharmacy and ADRs. Although the criteria of Beers³⁸ may also be useful guidelines for clinicians, there may be individual instances in which medications

Table 5. Inappropriate Medications in the Elderly (Considering Diagnosis)

Illness	Drug
Diabetes	β-Adrenergic blocking agents, corticosteroids
Chronic obstructive pulmonary disease	β-Adrenergic blocking agents, sedatives/hypnotics
Asthma	β-Adrenergic blocking agents
Benign prostatic hypertrophy	Anticholinergic antihistamines, gastrointestinal tract antispasmodic drugs, muscle relaxants, narcotics, oxybutynin, bethanechol, anticholinergic antidepressant drugs
Heart failure	Disopyramide
Hypertension	Amphetamines, diet pills
Ulcers	Nonsteroidal anti-inflammatory drugs, aspirin (>325 mg), potassium supplements
Peripheral vascular disease	β-Adrenergic blocking agents
Incontinence	α-Adrenergic blocking agents
Constipation	β-Adrenergic blocking agents, narcotic drugs, tricyclic antidepressants
Insomnia	Decongestants, theophylline, β-agonists, desipramine, selective serotonin reuptake inhibitors, methylphenidate
Seizures	Clozapine, thiorazine, thioridazine, chlorprothixene

Adapted from reference 38.

listed in Tables 4 and 5 can be used with extreme caution if other treatment options are not available. The use of dipyridamole, eg, has recently been reconsidered as perhaps being appropriate for use in the secondary prevention of strokes.⁴⁴

Other drugs may also place the elderly at increased risk for ADRs. Cimetidine, eg, may be one such medication. Cimetidine, in contrast to the other H₂ blockers, may cause depression, lethargy, or confusion in the elderly.⁴⁵ In addition, cimetidine may have antiandrogenic effects and may inhibit the metabolism of other medications, such as phenytoin, warfarin, and theophylline.⁴⁵ Glyburide is associated with a higher risk of severe hypoglycemia compared with glipizide (relative risk = 1.9).⁴⁶ There may also be an association between certain medications, such as digoxin, selective serotonin reuptake inhibitors, and theophylline, and anorexia in frail older adults.⁴⁷ In addition, advanced age is a major risk factor for nonsteroidal anti-inflammatory drug-induced upper gastrointestinal tract bleeding.⁴⁸ Recent studies^{49,50} have shown that piroxicam and ketoprofen are the 2 nonsteroidal anti-inflammatory drugs associated with the highest relative risk of gastrointestinal tract bleeding in elderly patients.

Although the criteria have been used to estimate the prevalence of inappropriate medications, they likely underestimate the potential risk of ADRs. The expert panel did not address the issue of inappropriate drug combinations. Likewise, the notion of drug dosage limitations is addressed only for short-acting benzodiazepines and digoxin. The appropriate duration of medication use, which is of great importance with regard to psychotropic medication, was not addressed. Probably the biggest shortcoming of the criteria by Beers³⁸ is its failure to address the appropriateness of new medications. Even now, many of the medications on the list are rarely used. Instead, new drugs are continuously being marketed. As stated previously, most of these drugs have not been adequately studied in the high-risk geriatric population.

Managed care organizations may provide an opportunity to restrict the use of inappropriate medications through the use of restrictive formularies. Drug utilization review coupled with physician education may provide another means for limiting new, potentially inappropriate medications.⁵¹

Federal Governmental Regulation

In 1987, the federal government enacted legislation regulating the use of antipsychotic medications in long-term care facilities as part of the Nursing Home Reform Amendments of the Omnibus Budget

Reconciliation Act (OBRA-87).^{52,53} The excessive use of antipsychotic drugs in the frail elderly has been associated with increased rates of altered mental status, pressure ulcers, muscle atrophy, falls, and deconditioning.⁵⁴ Regarding antipsychotic medications, the OBRA-87 regulations require (1) a properly documented diagnostic indication, (2) adherence to recommended dosage limitations, and (3) documentation of appropriate target symptoms.⁵⁵ In the years following passage of OBRA-87, use of anxiolytics, hypnotics, and antidepressants in long-term residents have also come under federal governmental regulation.

Passage of OBRA-87 has resulted in a significant decrease in antipsychotic drug use in nursing home residents. During a 30-month period following implementation of the OBRA-87 guidelines, Shorr et al⁵⁶ observed a 26.7% decline in antipsychotic drug use that resulted from a decrease in new users and a reduction in long-term drug use.

In addition to the OBRA regulations of psychotropic medications, the Health Care Financing Administration on July 1, 1999, enacted the 1999 Federal Long-Term Care Survey Process and Interpretive Guidelines.⁵⁷ The medications listed in Table 5 are to be used as a "quality indicator" in the survey of medical charts from long-term care institutions. It is important to note that these regulations apply only to nursing home residents and not to the larger frail homebound population.³⁷

Role of the Clinical Pharmacist

Recognizing the complex and interrelated issues associated with prescribing medications for elderly patients, the role of the clinical pharmacist has often been helpful in minimizing these problems. Studies have shown that an active interdisciplinary approach involving clinical pharmacists can improve geriatric drug prescribing^{58,59} and decrease the total number of medications prescribed to the elderly. Participation of a clinical pharmacist on clinical rounds was recently shown to decrease ADRs in an intensive care setting.⁶⁰

Computer-Based Medication Ordering

Computer prompts can be used as reminders to physicians and clinical pharmacists at the time of ordering.⁶¹ Computer-based prescribing protocols can provide immediate feedback regarding potential adverse effects and drug-drug interactions, with "on-screen" information justifying specific modifications. This computer information also becomes a source of review data for drug utilization monitoring. Monane et al⁶² recently showed that a computerized drug uti-

lization review database linked to a telepharmacy led to a 24% decrease in inappropriate prescribing. Another study by Raschke et al⁶³ showed that computer-based alerts identified opportunities to prevent ADRs at a rate of 64 per 1000 admissions.

Educational Initiatives

Managed care organizations offer an avenue for education for both healthcare providers and patients. Managed care organizations can provide standardized continuing education for their affiliated providers, pharmacists, and case managers. This education can focus on the identification and management of specific geriatric issues, such as polypharmacy, dementia, and falls, that place older patients at increased risk for ADRs. Patient education itself must be addressed as another important method of intervention. Studies have consistently shown a reduction in the number of medications used, improved outcome, and decreased costs.⁶⁴⁻⁶⁷ Improving patient knowledge through education can also improve patient compliance.⁶⁸ In patients with depression, patient counseling was shown to improve medication compliance, whereas treatment leaflets for patients had no significant effect on adherence.⁶⁹ It is important that educational interventions be culturally sensitive because the percentage of minority elderly in the United States continues to grow, from 10.2% in 1990 to a projected 15.3% by the year 2020.⁷⁰

Disease Management Programs

Managed care organizations are also potentially an important vehicle for addressing the issue of geriatric underprescribing. Managed care organizations have the resources to develop disease management programs (using case managers) and clinical pathways for common chronic diseases. Programs have been developed for such diseases as congestive heart failure and diabetes. Although these programs may often increase pharmacy costs, they can lead to improved quality of care and economic outcomes for the MCO.⁷¹ Another example is the use of donepezil, which is an expensive medication that may reduce the total cost of caring for patients with Alzheimer's disease.⁷² They also have access to databases to monitor the clinical and economic effects of these programs.

the issues of polypharmacy, ADRs, noncompliance, and underprescribing will have a major impact on the delivery of care by MCOs as the demographics of the United States continue to change. Although the number of elderly is expected to increase from the current 12% to 22% by 2030, the age group of 85 years and older is currently the fastest growing segment of the US population.⁴⁵

The increasing direct costs of prescription medications and the indirect costs resulting from ADRs and noncompliance are of great concern in the delivery of cost-effective managed care. The consensus criteria in Tables 4 and 5, along with the basic prescribing principles listed in Table 2, represent only an initial step in the improvement of the quantity and quality of medications prescribed for frail elderly patients.

The large and often centralized databases of managed care systems may provide an opportunity to address many of these medication issues. Managed care organizations have the opportunity to develop computer-based interventions for large outpatient populations to address the issues of polypharmacy and inappropriate medication prescribing. In addition, the large databases of the MCOs offer the opportunity for continuous quality improvement in the development of formulary restrictions and to ensure that medications shown to be beneficial in evidence-based studies are in fact prescribed to elderly patients. The managed care environment also offers opportunities for the education of healthcare providers and patients.

Although these opportunities may exist, simple guidelines will not provide the entire solution because the issues of polypharmacy, inappropriate medications, and underprescribing may conflict in the heterogeneous elderly population. We believe that attempts to control polypharmacy and ADRs cannot be accomplished solely through rigid guidelines but must contain a component for individual clinical review. Guidelines that define a number of medications, such as the use of 9 or more in nursing home residents, as being "inappropriate" fails to take into account that the nursing home population is becoming more medically complex and frail.⁷³ Further research is needed to study the effects of new medications specifically in elderly patients in clinical trials and postmarketing surveillance.

...CONCLUSIONS ...

Proper drug therapy management in the elderly is an important issue for both primary care providers and specialists caring for these people. Addressing

...REFERENCES ...

1. Schwartz JB. Geriatric clinical pharmacology. In: Kelly W, ed. *Textbook of Internal Medicine*. 3rd ed. New York, NY: Lippincott-Raven;1997:2547-2554.

2. Stuck AE, Beers MH, Steiner A, et al. Inappropriate medication use in community-residing older persons. *Arch Intern Med* 1994;154:2195-2200.
3. Hurwitz A, Brady DA, Schaal SE, et al. Gastric acidity in older adults. *JAMA* 1997;278:659-662.
4. Golden AG, Silverman MA, Preston RA. University of Miami Division of Clinical Pharmacology therapeutic rounds: Issues in prescribing for geriatric patients and emerging practice guidelines. *Am J Ther* 1999;6:341-348.
5. Colley CA, Lucas LM. Polypharmacy: The cure becomes the disease. *J Gen Intern Med* 1993;8:278-283
6. Stewart RB, Moore MT, May FE, et al. Changing patterns of therapeutic agents in the elderly: A 10-year overview. *Age Ageing* 1991;20:182-188
7. Hurwitz N. Predisposing factors in adverse drug reactions. *BMJ* 1969;1(643):536-539.
8. Lindley CM, Tully MP, Paramsoth V, Tallis RC. Inappropriate medication is a major cause of adverse drug reactions in elderly patients. *Age Ageing* 1992;21:294-300.
9. Gibian T. Rational drug therapy in the elderly, or how not to poison your elderly patients. *Aust Fam Physician* 1992;21:1755-1759.
10. Kane RL, Ouslander JG, Abrass IB. Drug therapy. In: *Essentials of Clinical Geriatrics*. 3rd ed. New York, NY: McGraw-Hill Co;1994:350-384.
11. Vogenberg FR. Trends in managed care pharmacy benefits. *Hosp Pharm* 1999;34:1263-1267.
12. Motheral BR, Henderson R. The effect of a copay increase on pharmaceutical utilization, expenditures, and treatment continuation. *Am J Manag Care* 1999;5:1383-1394.
13. Halas C. Optimizing drug use in elderly patients. *Am Druggist* February, 1999:56-62.
14. Rochon PA, Gurwitz JH. Prescribing for seniors, neither too much nor too little. *JAMA* 1999;282:113-115.
15. Krumholz HM, Radford MJ, Wang Y, et al. Early β -blocker therapy for acute myocardial infarction in elderly patients. *Ann Intern Med* 1999;131:648-654.
16. Giugliano RP, Camargo CA, Lloyd-Jones DM, et al. Elderly patients receive less aggressive medical and invasive management of unstable angina. *Arch Intern Med* 1997;158:1113-1120.
17. Krumholz HM, Radford MJ, Wang Y, et al. National use and effectiveness of β -blockers for the treatment of elderly patients after acute myocardial infarction. *JAMA* 1998;280:623-629.
18. Krumholz HM, Radford MJ, Ellerbeck EF, et al. Aspirin for secondary prevention after acute myocardial infarction in the elderly: Prescribed use and outcomes. *Ann Intern Med* 1996;124:292-298.
19. Berlowitz DR, Ash AS, Hickey EC, et al. Inadequate management of blood pressure in a hypertensive population. *N Engl J Med* 1998;339:1957-1963.
20. Havranek EP, Abrams F, Stevens E, Parker K. Determinants of mortality in elderly patients with heart failure. *Arch Intern Med* 1998;158:2024-2028.
21. Gattis WA, Larsen RL, Hasselblad V, et al. Is optimal angiotensin-converting enzyme inhibitor dosing neglected in elderly patients with heart failure? *Am Heart J* 1998;136:43-48.
22. Barron HV, Michaels AD, Maynard C, Every NR. Use of angiotensin-converting enzyme inhibitors at discharge in patients with acute myocardial infarction in the United States: Data from the National Registry of Myocardial Infarction 2. *J Am Coll Cardiol* 1998;32:360-367.
23. Handa VL, Landerman R, Hanlon JT, et al. Do older women use estrogen replacement? Data from the Duke Established Populations for Epidemiologic Studies of the Elderly (EPESE). *J Am Geriatr Soc* 1996;44:1-6.
24. Williams JW, Mulrow CD, Kroenke K, et al. Case-finding for depression in primary care: A randomized trial. *Am J Med* 1999;106:36-43.
25. Redelmeir DA, Tan SH, Booth GL. The treatment of unrelated disorders in patients with chronic medical diseases. *N Engl J Med* 1998;338:1516-1520.
26. Bender K, McKenzie MW, Stewart RB. Defining the adverse drug reaction sequence. *J Am Pharm Assoc* 1976; 76:244-247.
27. Montamat SC, Cusack BJ, Vestal RE. Management of drug therapy in the elderly. *N Engl J Med* 1989;321:303-310.
28. Cadieux RJ. Drug interactions in the elderly: How multiple drug use increases risk exponentially. *Postgrad Med* 1989;86:179-186.
29. Nolan L, O'Malley K. Prescribing for the elderly, I: Sensitivity of the elderly to adverse drug reactions. *J Am Geriatr Soc* 1988;36:142-149.
30. Steel K, Gertman PM, Crescenzi Anderson J. Iatrogenic illness on a general medical service at a university hospital. *N Engl J Med* 1981;304:638-642.
31. Beers MH, Fingold SF, Ouslander JG, et al. Characteristics and quality of prescribing by doctors practicing in nursing homes. *J Am Geriatr Soc* 1993;41:802-807.
32. Brewer T, Colditz GA. Postmarketing surveillance and adverse drug reactions. *JAMA* 1999;281:824-829.
33. Williams B, Betley C. Inappropriate use of nonpsychotropic medications in nursing homes. *J Am Geriatr Soc* 1995;43:513-519.
34. Willcox SM, Himmelstein DU, Woolhandler S. Inappropriate drug prescribing for the community-dwelling elderly. *JAMA* 1994;272:292-296.
35. Golden A, Preston RA, Llorente MA, et al. Inappropriate prescribing in home-bound older adults. *J Am Geriatr Soc* 1999;47:948-953.
36. Aparasu RR, Fliginger SE. Inappropriate medication prescribing for the elderly by office-based physicians. *Ann Pharmacother* 1997;31:823-829.
37. Schmader KE, Hanlon JT, Landsman PB, et al. Inappropriate prescribing and health outcomes in elderly veteran outpatients. *Ann Pharmacother* 1997;31:529-533.
38. Beers MH. Explicit criteria for determining potentially inappropriate medication use by the elderly. *Arch Intern Med* 1997;157:1531-1536.
39. Tinetti ME, Speechley M. Prevention of falls among the elderly. *N Engl J Med* 1989;320:1055-1059.
40. Ray WA, Griffin MR, Downey W. Benzodiazepines of long and short elimination half-life and the risk of hip fracture. *JAMA* 1989;262:3303-3307.
41. Ried LD, Johnson RE, Gettman DA. Benzodiazepine

- exposure and functional status in older people. *J Am Geriatr Soc* 1998;46:71-76.
42. Nowell PR, Mazumdar S, Buysse DJ, et al. Benzodiazepines and zolpidem for chronic insomnia. *JAMA* 1997;278:2170-2177.
43. Kaliner MA. Clinical use of H₁ antihistamines in elderly patients: Considerations in a polypharmaceutical patient population. *Clin Geriatr* 1997;5:75-88.
44. Diener HC, Cunha L, Forbes J, et al. European Stroke Prevention Study 2: Dipyridamole and acetylsalicylic acid in the secondary prevention of stroke. *J Neurol Sci* 1996;143:1-13.
45. Over-the-counter H₂-receptor antagonists for heartburn. *Med Lett Drugs Ther* 1995;37:95-96.
46. Shorr RI, Ray WA, Daugherty JR, Griffin MR. Individual sulfonylureas and serious hypoglycemia in older people. *J Am Geriatr Soc* 1996;44:751-755.
47. Morley JE. Anorexia of aging: Physiologic and pathologic. *Am J Clin Nutr* 1997;66:760-773.
48. Bjorkman DJ. Nonsteroidal anti-inflammatory drug-induced gastrointestinal injury. *Am J Med* 1996;101(suppl):25S-31S.
49. Garcia Rodriguez LA, Cattaruzzi C, Troncon MG, Agostinis L. Risk of hospitalization for upper gastrointestinal tract bleeding associated with ketorolac, other nonsteroidal anti-inflammatory drugs, calcium antagonists, and other anti-hypertensive drugs. *Arch Intern Med* 1998;158:33-39.
50. Leipzig RM. Avoiding adverse drug effects in elderly patients. *Cleve Clin J Med* 1998;65:470-477.
51. Monane M, Nagle B, Kelly MA. Pharmacotherapy: Strategies to control drug costs in managed care. *Geriatrics* 1998;53:51-52, 54, 63.
52. Furner SE, Brody JA, Jankowski LM. Epidemiology of aging. In: Cassel CK, et al, eds. *Geriatric Medicine*. 3rd ed. New York, NY: Springer Publishing Co Inc;1997:37-43.
53. Avorn J, Gurwitz JH. Drug use in the nursing home. *Ann Intern Med* 1995;123:195-204.
54. Slone PD. Alternatives to physical and pharmacological restraints in long-term care. *Am Fam Physician* 1992;15:763-769.
55. Llorente MD, Olsen EJ, Leyva O, et al. Use of antipsychotic drugs in nursing homes: Current compliance with OBRA regulations. *J Am Geriatr Soc* 1998;46:198-201.
56. Shorr RI, Fought RL, Ray WA. Changes in antipsychotic drug use in nursing homes during implementation of the OBRA-87 regulations. *JAMA* 1994;27:358-362.
57. Health Care Financing Administration. *1999 Federal Long-term Care Survey Process and Interpretive Guidelines*:F329. National Information Network: Sunbury, OH;1999.
58. Lipton HL, Bero LA, Bird JA, McPhee SJ. The impact of clinical pharmacist's consultations on physician's geriatric drug prescribing: A randomized controlled trial. *Med Care* 1992;30:646-655.
59. Schmidt IK, Claesson CB, Westerhom B, Nilsson LG. Physician and staff assessments of drug interventions and outcomes in Swedish nursing homes. *Ann Pharmacother* 1998;32:27-32.
60. Leape LL, Cullen DJ, Dempsey Clapp M, et al. Pharmacist participation on physician rounds and adverse drug events in the intensive care unit. *JAMA* 1999;282:267-270.
61. Schanock GT, Maswaba TR, McBride JM, Clark T. Automated order-entry mechanism to influence prescribing. *Top Hosp Pharm Manage* 1994;14:21-29.
62. Monane M, Matthias DM, Nagle BA, Kelly MA. Improving prescribing patterns for the elderly through an online drug utilization review intervention: A system of linking the physician, pharmacist and computer. *JAMA* 1998;280:1249-1252.
63. Raschke RA, Gollihare B, Wunderlich TA, et al. A computer alert system to prevent injury from adverse drug events: Development and evaluation in a community teaching hospital. *JAMA* 1998;280:1317-1320.
64. Hammerlun ER, Ostrom JR, Kethley AJ. The effect of drug counseling and other educational strategies on drug utilization of the elderly. *Med Care* 1985;23:165-179.
65. Hopper SV, Miller JP, Birge C, Swift J. A randomized study of the impact of home health aides on diabetic control and utilization patterns. *Am J Public Health* 1984;74:600-602.
66. Eraker SA, Kitscht JP, Becker MH. Understanding and improving patient compliance. *Ann Intern Med* 1984;100:258-268.
67. O'Connell MB, Johnson JF. Evaluation of medication knowledge in elderly persons. *Ann Pharmacother* 1992;26:919-921.
68. Green LW, Mullen KD, Stanbrook GL. Programs to reduce drug errors in the elderly: Direct and indirect evidence of patient education. *J Geriatr Drug Ther* 1986;1:3-17.
69. Peveler R, George C, Kimmonth A, Campbell M, Thompson C. Effect of antidepressant drug counseling and information leaflets on adherence to drug treatment in primary care: Randomized controlled trial. *BMJ* 1999;319:612-615.
70. Creary L, Brooks T. Ethnogeriatrics: Unique health issues of culturally diverse elderly. In: Yoshikawa TT, Cobbs EL, Brummel-Smith K, eds. *Practical Ambulatory Geriatrics*. 2nd ed. St. Louis, MO: Mosby;1998:80-92.
71. Knight W. Too much or too little? The role of pharmaceuticals in the health care system. *J Manag Care Pharm* 1999;5:296-302.
72. Neumann PJ, Hermann RC, Kuntz KM, et al. Cost-effectiveness of donepezil in the treatment of mild or moderate Alzheimer's disease. *Neurology* 1999;52:1138-1145.
73. Goldberg SL. Where have nursing homes been? Where are they going? *Generations* 1995;19:78-81.

CME QUESTIONS: TEST #070002

This activity has been planned and produced in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education. The Johns Hopkins University School of Medicine is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians. The Johns Hopkins University School of Medicine takes responsibility for the content, quality, and scientific integrity of this CME activity.

The Johns Hopkins University School of Medicine designates this educational activity for a maximum of 1 hour(s) in category 1 credit towards the AMA Physician's Recognition Award. Each physician should claim only those hours of credit that he/she actually spent in the educational activity.

Instructions

After reading the article "Achieving Control of Diabetic Risk Factors in Primary Care Settings," select the best answer to each of the following questions. In order to receive 1 CME credit, at least 7 of the 10 answers must be correct. Estimated time for this activity is 1 hour. CME credits are distributed on a yearly basis.

1. The therapeutic goal for glycosylated hemoglobin (HbA_{1c}) in a patient with diabetes is:

- a) <8.0%
- b) <6.5%
- c) <7.0%
- d) <8.5%
- e) <10%

2. Which of the following drugs have favorable long-term data supporting their use for management of hypertension in diabetes?

- a) β-blockers
- b) diuretics
- c) angiotensin-converting enzyme inhibitors
- d) b and c only
- e) a, b, and c

3. Patients with diabetes and hypertension should have their blood pressure lowered to:

- a) 140/90 mm Hg
- b) 130/80 mm Hg
- c) 160/80 mm Hg
- d) 120/80 mm Hg
- e) 130/90 mm Hg

4. Most adults with diabetes should have which of the following tests performed at least annually?

- a) dilated eye exam
- b) lipid profile
- c) urine microalbuminuria
- d) comprehensive foot exam
- e) all of the above

5. Which of the following drugs have favorable long-term data supporting their use for management of hypercholesterolemia in diabetes?

- a) niacin
- b) statins
- c) cholestyramine
- d) a and b only
- e) a, b, and c

6. Aspirin therapy is only indicated for diabetic patients who have had a heart attack or stroke already.

- a) true
- b) false

CME TEST FORM

AJMC Test #070002

Achieving Control of Diabetic Risk Factors in Primary Care Settings

(Test valid through April 30, 2002. No credit will be given after this date.)

Please circle your answers:

1. a b c d e
2. a b c d e
3. a b c d e
4. a b c d e
5. a b c d e
6. a b
7. a b
8. a b
9. a b c d e
10. a b c d e

(PLEASE PRINT CLEARLY)

Name _____
 Address _____
 City _____
 State/ZIP _____
 Phone # _____

Please enclose a check for \$10, payable to American Medical Publishing, and mail with this form to:

The AJMC CME Test
 American Medical Publishing
 Suite 102
 241 Forsgate Drive
 Jamesburg, NJ 08831

...CME QUIZ ...

PROGRAM NO. 070002 EVALUATION

Johns Hopkins University School of Medicine appreciates your opinion on this article. Please fill out the questionnaire below, tear off along the dotted line, and mail along with your CME test form. We thank you for your evaluation, which is most helpful in planning future programs.

On the whole, how do you rate the information presented in the article?

excellent good fair poor

Is the information presented useful in your practice?

yes no

Do you have recommendations to improve this program?

yes no

Comments:

Were any portions of this program unsatisfactory or inappropriate?

yes no

If so, which?

Do you find the information presented in this article to be fair, objective, and balanced?

yes no

Is there subject matter you would like included in the future?

yes no

Comments:

In your opinion, were the authors biased in their discussion of any commercial product or service?

yes no

Comments:

Program Title

Physician Name

Address

City, State, ZIP

Specialty

7. The leading cause of death among patients with diabetes is cardiovascular disease.

- a) true
- b) false

8. Randomized clinical trials have failed to show any benefit from adding bedtime insulin therapy to daytime oral diabetes therapy.

- a) true
- b) false

9. Which of the following has been demonstrated to increase compliance with diabetes treatment recommendations?

- a) diabetes registries
- b) flow sheets
- c) provider education
- d) practice guidelines
- e) all of the above

10. Dietary recommendations for patients with diabetes include:

- a) cholesterol <300 mg/day
- b) saturated fat <10% of calories per day
- c) no sucrose/less than 2000 calories daily
- d) a and b only
- e) a, b, and c