

Five ways you can reduce inappropriate prescribing in the elderly: A systematic review

Practice recommendations

- Obtain pharmacist recommendations to reduce inappropriate prescribing and adverse drug events (B).
- In the inpatient setting, use computerized alerts to reduce serious medication errors and help prevent adverse drug events (B).
- Review a patient's medications to reduce polypharmacy and inappropriate prescribing (A).
- Educate patients to improve compliance with medications, reduce polypharmacy, reduce inappropriate prescribing, and decrease adverse events (A).
- Consider using the Beers criteria for avoiding inappropriate drugs in the elderly.

Around one third of elderly persons hospitalized end up there because of adverse drug events. Among the ambulatory elderly, 35% experience such events in a single year. The hopeful outlook is that, depending on the setting, between 25% and 95% of these events can be prevented by reducing inappropriate prescribing.

In this article we discuss 5 recommendations for reducing inappropriate medications, and offer steps to implement these recommendations.

Factors that lead to inappropriate prescribing

Inappropriate prescribing to elderly patients is increasing. It is not uncommon for older patients to receive 1 or more medications from their primary care physician and additional medications from specialty physicians, with each physician unaware of medications prescribed by the others.¹ As the number of providers following the patient increases, so does the number of medications.²

One result is that the elderly use a disproportionate number of medications. They make up 13% of the US population but receive 34% of all prescriptions and consume 40% of all nonprescription medications.^{3,4} A recent national study of non-institutionalized US adults revealed that 90% of persons 65 years or older used at least 1 medication per week. More than 40% used 5 or more medications per week, and 12% used 10 or more per week.⁵ This situation may become more complicated as by the year 2030, the elderly are expected to make up 20% of the US population.⁶

Inappropriate prescribing, including polypharmacy, is a major contributing factor to adverse drug events in older patients (see **Scope of the problem**). A recent nested case-controlled study in a large multi-specialty group revealed an association between number of medications, doses of medications, and adverse drug events.¹³

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Scope of the problem

Hypertension specialists debate about how to approach them. In the year 2000, medication-related problems were responsible for 106,000 deaths at a cost of \$85 billion to our healthcare system.^{7,8}

It has been estimated that 30% of hospital admissions in elderly patients are due to drug-related problems.⁹ In addition, approximately two thirds of nursing facility residents will experience an adverse drug event over a 4-year period of time, with 1 in 7 of these residents requiring hospitalization.^{10,11}

Ambulatory patients are also affected. A cohort study revealed that approximately 35% of ambulatory elderly experienced an adverse drug event over a 1-year period, 63% of whom required the attention of a physician.⁹ Another large cohort study, involving 30,347 Medicare enrollees cared for by a multispecialty group practice, demonstrated that adverse drug events are not only common among the elderly, but over 25% of the adverse events during a 12-month period were preventable.¹² Other studies have estimated that up to 95% of adverse drug events are preventable.³ These figures are particularly troubling when considering our older patient population because 51% of all deaths caused by adverse reactions to medications occur in patients over 60 years of age.⁴

Adverse drug events may occur for several reasons including noncompliance, drug-drug interactions, and physician error.

The problem of polypharmacy as it relates to adverse drug events is so extensive that it was designated as the principal medication safety issue in the Healthy People 2000 report.¹⁴

■ Methods

In this systematic review, English language studies from January 1990 to January 2006 were searched on Medline and the Cochrane Database of Systematic Reviews. Among the specific keywords and phrases we used: *adverse drug events in the elderly; inappropriate medications in the elderly; polypharmacy in the elderly; reduction of polypharmacy in the elderly; drug-drug interactions in the elderly; pre-*

vention of adverse drug events; and reduction of inappropriate prescribing in the elderly. The search was limited to studies of patients over 65 years of age.

Fifty-nine articles were identified using the above search strategy. In selecting articles on which to base the recommendations in this paper, we gave first priority to randomized controlled trials. When randomized controlled trials did not exist, we used cohort studies or meta-analyses. We excluded review articles and articles that did not specifically address the issue of reducing inappropriate prescribing for elderly patients.

■ Results

TABLE W1 (available online at www.jfponline.com) describes the results of the systematic review. Of the initial 59 articles, we excluded 26 review articles and 13 that did not address inappropriate prescribing. The remaining 19 articles were classified into 5 categories based on the methods studied for reducing inappropriate prescribing. The methods recommended in each of the 5 categories were supported by varying levels of evidence.

Four methods were supported by controlled trials, thus providing a higher level of evidence to support: 1) incorporating pharmacist recommendations, 2) use of computerized alerts, 3) review of patient's medication list and 4) patient education (**TABLE W2**, available online at www.jfponline.com). The fifth method, avoiding inappropriate medications, was based on consensus guidelines and expert opinions.

Method 1: Incorporate pharmacist recommendations

Having a pharmacist participate in the care of elderly patients can reduce polypharmacy and adverse drug events.

A randomized controlled trial of 208 patients at a Veterans' Administration (VA) medical clinic, aged 65 years of age or older and taking 5 or more medications, demonstrated that involving a clinical pharmacist in the patient's care reduces

inappropriate prescribing and adverse drug effects without adversely affecting health-related quality of life.¹⁵

In this VA study, patients were randomized to an intervention group and a control group. In the intervention group, a clinical pharmacist met with patients during all scheduled office visits to evaluate and make recommendations about their drug regimens. Before each visit, the clinical pharmacist reviewed the patient's medical record and current medications, and assessed each medication using the "Medication Appropriateness Index" as a guideline.^{18,19} Written drug therapy recommendations were then sent to the physician.

Key outcome measures in this study were the rate of prescribing inappropriateness, medication compliance and knowledge, number of medications, adverse drug events, health-related quality of life, patient satisfaction, and physician receptivity to the intervention.

The results show that inappropriate prescribing and the number of drugs prescribed decreased by 24% in the intervention group but only by 6% in the control group. In addition, fewer intervention-group patients than control patients experienced adverse drug events (30% vs. 40%; $P=.19$). Physicians were receptive to the clinical pharmacist's interventions and enacted changes recommended by the clinical pharmacist more frequently than they enacted changes independently for control patients (55.1% vs. 19.8%; $P=.001$).¹⁵

Engaging the pharmacist. Encourage your patients to fill prescriptions by all physicians at the same pharmacy, thereby enabling the maintenance of a single current list of medications. Have your office staff alert the pharmacist whenever a medication is discontinued.

When a patient refills medications, the pharmacist routinely reviews the database for potential adverse drug events. The pharmacist should then alert the physician of potential inappropriate medications or adverse drug events.

Method 2: Use computerized alerts

Computerized alerts provide warnings to physicians using computerized order entry systems. The system contains information on patients' current medications and drug intolerances and allergies. An "alert" is generated by the system when there is a potential drug allergy, drug intolerance or drug interaction as defined by the National Drug Data File of First Databank Inc. The use of computerized alerts for reducing polypharmacy and inappropriate prescribing has been examined in both outpatient and inpatient settings.

Outpatient. A recent study examined the rate at which physicians overrode computerized alerts among 3481 consecutive alerts generated at 5 adult primary care practices that used a common computerized physician order entry system for prescription writing.²⁰ Of the 3481 consecutive alerts, physicians overrode 91.2% of the alerts but 8.8% resulted in a change in prescribing.

Although few physicians changed their prescriptions in response to an alert, there were few adverse drug events despite the large number of alerts that were overridden. This may have indicated an alert threshold that was set too low.²¹

Inpatient. A randomized comparison study conducted at a large tertiary hospital demonstrated that physician computer order entry decreased the rate of serious medication errors by more than half.¹⁶ This study was divided into 2 phases. Phase I involved 2491 admissions and was designed as "baseline." Phase II involved 4220 admissions that occurred after the intervention was implemented. The intervention itself was implementation of a computerized order entry system that required the ordering physician to complete a menu of information including drug name, medication dose, route, and frequency. Computerization ensured legibility of all orders. The main outcome measured was serious medication errors.

In comparison of the 2 phases, serious medication errors decreased 55%, from 10.7 events per 1000 patient-days in Phase

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Brown bag evaluations, with attention to nonprescription medications, decreases polypharmacy

I to 4.86 events per thousand in Phase II ($P=.1$). Preventable adverse drug events declined 17%, while most significantly potential adverse drug events declined 84%.¹⁶

Another study, this one a randomized controlled study of electronic alerts to remind physicians of prescribed measures to prevent venous thromboembolism in hospitalized patients, also found benefit to an alert system. But the results showed that 3 conditions are needed for the success of the clinical alerts. First, there must be acceptance by the physicians. Secondly, the electronic alerts should deliver simple messages that prevent physicians from routinely bypassing them. Thirdly, the physician should have access to all pertinent information to make an adequate decision.²¹

Method 3: Review of medications

Reviewing a patient's medications regularly can reduce polypharmacy and inappropriate prescribing. This has been shown in at least 4 studies.

Physicians often unaware of what patients are, or are not, taking. One prospective observational study of medication review showed a high rate of discrepancy between medications the physician thought a patient was taking and those the patient actually was taking. This study involved patients 65 years of age or older who were taking 4 or more medications. There were 50 physicians-patient pairs blinded at the initial visit. After the initial visit, physicians were given the patient's chart, with a request to complete a questionnaire on all prescription and nonprescription medications with dosages and frequencies of administration. All patient records contained a flow sheet for review of medications including current, discontinued, and over-the-counter medications.

Home visits were conducted 10 days after initial visits to gather detailed information from patients regarding their understanding of medication regimens. Data obtained showed that 74% of patients were taking at least 1 medication the physician was unaware of, or were not

taking a medication the physician thought they were taking. Moreover, in 12% of cases, there were discrepancies in understanding about dose or frequency of medication regimens.²²

"Brown bag" assessment useful. In the second study, a program promoting medication reviews between primary care physicians and their elderly patients significantly changed prescribing by physicians. In this prospective study, elderly patients taking 5 or more medications were sent a letter encouraging them to meet with their primary care physician for a medication review. Interventions included notifying the physician that their patients were at high risk for inappropriate prescribing, providing the physician with a "medication management" report that listed all prescriptions, doses, and pills dispensed per prescription, and clinical practice guidelines for effectively preventing and managing inappropriate prescribing. These guidelines emphasized the "brown bag" medication review of both nonprescription and prescription medications (ie, having the patient bring all their medication to the office in a brown bag).

With this intervention, 20% of patients reported discontinuation of a medication, 29% reported a change in medication, and 17% reported a medication that the physician did not know the patient was taking. Forty-five percent of physicians made at least 1 change in a patient's medication regimen.²³

Include all preparations patients use. A third study showed that the medication review should focus not just on prescription drugs but also on nonprescription agents such as vitamins, laxatives, minerals, analgesics, and herbal and natural remedies. This prospective cross-sectional study at 3 university affiliated geriatric clinics involved a room-to-room search of patients' homes to identify all substances a patient might be taking. The medications identified in the home were compared with the medication list in the clinic and with medications found in the "brown bag evaluation" and by interview. The physician's

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Review OTC agents, including vitamins and minerals, and not just prescriptions

understanding of medications a patient was taking matched the patient's actual use of medications only 52% of the time; much of the mismatch was attributable to nonprescription medications.²⁴

Finally, in a fourth study, a randomized controlled trial, 133 community dwelling adults taking 5 or more medications were assessed at baseline by physician exam, symptom review, and objective tests of physical and cognitive functioning. Sixty-three subjects were randomized to the intervention group and 77 to the control group.

The primary intervention was a review and modification of a patient's medication regimen by a multidisciplinary team consisting of a consultant pharmacist, physician, and nurse. This intervention was not available to the control group. Medication usage in both groups was re-evaluated at 6 weeks using a brown-bag review.

The control group decreased their medication use by an average of 0.04 medications per month, while the intervention subjects decreased their medications by an average of 1.5 drugs (although the team has actually recommended discontinuation of an average of 4.5 drugs per patient). The difference between recommended discontinuation and actual discontinuation was attributed to patients' resistance to changing medications.

Intervention subjects saved an average of \$26.92 per month in wholesale costs while control subjects saved an average of \$6.75 per month. No differences in functioning were observed between groups.¹⁷

Method 4: Patient education

The most beneficial intervention may be enhancing communication between providers and patients, and educating patients about medication regimens, potential side effects, and adverse drug events.

Encourage reporting of symptoms. A recent prospective cohort study showed that 63% of preventable events were attributed to the physician's failure to respond to medication-related symptoms; 37% were due to the patient's failure to

TABLE

Potentially inappropriate medications in the elderly

MEDICATION	POTENTIAL ADVERSE EFFECT
Meperidine (Demerol)	Confusion
Propoxyphene (Darvon)	CNS effects
Diphenhydramine (Benadryl)	Sedation
Long-term use of NSAIDs	GI bleeding
Amitriptyline (Elavil)	Sedation/anticholinergic effects
Methyldopa (Aldomet)	Bradycardia
Diazepam (Valium)	Sedation
Cimetidine (Tagamet)	Confusion
Nitrofurantoin (Macrochantin)	Potential renal insufficiency
Clonidine (Catapres)	Hypotension/CNS effects
Disopyramide (Norpace)	Heart failure
Ketorolac (Toradol)	GI bleeding
Short-acting nifedipine (Procardia)	Hypotension
Doxazosin (Cardura)	Hypotension

inform the physician of the symptoms.²⁵

Intensive counseling reaps big benefits.

In a second study, the South Dakota Medication Reduction Project, educational presentations by pharmacists and one-on-one sessions between pharmacists and patients resulted in patients taking fewer medications and reducing dosages in medical regimens. This longitudinal study involved over 1000 older adults in rural and urban southeastern South Dakota communities over 6 months.

A pharmacist specializing in geriatrics gave a 30-minute presentation at various sites on medication-associated problems and "do's" and "don'ts" of medication use. This was followed by a 15-minute question-and-answer session.

A one-on-one 20-minute consultation between the pharmacist and patients followed the group presentation. The pharmacist recorded demographic data, med-

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Sending patients a simple letter advising specific drug reductions helps deter polypharmacy

ical history, medication names, doses, directions, and intended purposes, and obtained feedback about compliance and side effects. The pharmacist also provided oral counseling and written information about medications.

If a potentially serious drug-related problem was identified, a letter was sent to the patient's primary care physician, identifying key inappropriate prescribing concerns and offering alternative interventions for the physician's consideration.

Three months after the educational intervention, a telephone survey was performed. Survey results indicated that older adults participating in the one-on-one reviews were taking fewer medications, were more likely to take their medications, had dosage reductions, and increased their use of nonpharmacologic alternatives.²⁶

But even modest intervention pays off.

In another randomized study, a simple education intervention significantly reduced inappropriate prescribing for elderly patients. Participants in the intervention group taking more than 10 medications were sent a single letter recommending that medications be reduced. Similar participants in the control group did not receive letters.

The outcome measured was number of medications. In the notification group, an average reduction of approximately 3 medications occurred over a 4-month period. More complex intervention did not reduce inappropriate prescribing any further.²

Value of visual reminders. Another study showed that a simple visual intervention significantly reduced inappropriate prescribing. In this controlled trial, physicians were shown a medication grid that displayed all of their patient's medications and times of administration for 1 week. In the intervention group, medications decreased by 2.47 per patient. In the control group, medications increased by 1.65 per patient and doses increased by 3.83 per patient.²⁷

Try a team approach? Yet another randomized study showed that compared with usual care, education through an outpa-

tient geriatric evaluation and management program reduced the number of serious adverse drug events and inappropriate prescribing for frail elderly patients. Patient management guideline interventions consisted of regular assessments and medication recommendations by pharmacists. There was also a core team comprised of a geriatrician, social worker, and a nurse who participated in evaluation and management protocols such as medication reviews. The program reduced the risk of serious adverse drug events by 35%, compared with usual care of the geriatric patient.²⁸

Method 5: Avoid inappropriate medications

The Beers criteria aid in identifying medications to be avoided in older persons. They were developed in 1991, then updated in 1997 and again in 2003. In short, these criteria designate as "inappropriate" any medication that has shown the potential for adverse effects in the elderly.^{7,29,30}

In the 2003 update, a US consensus panel of experts used a modified Delphi method to review medications potentially ineffective or unsafe in the elderly.^{7,29,30} The **TABLE** shows selected examples of commonly used medications considered inappropriate.^{7,29-32}

Limited research supports use of the Beers criteria. The 1996 Medical Expenditure Panel Survey controlled for a number of confounding factors and found strong evidence of a sizable and consistent negative effect of using medications identified as inappropriate by the Beers criteria.³²

Discussion

The key findings of this study are that little evidence-based literature is available to guide recommendations for reducing inappropriate prescribing in elderly patients. Only a handful of randomized controlled trials have been conducted on the topic, and none of those trials involved persons older than age 85.

However, 4 methods for reducing inappropriate prescribing in the elderly are

supported by some evidence: 1) incorporating pharmacist recommendations; 2) using computerized alerts in the inpatient setting; 3) reviewing medications; and 4) educating patients. No research evidence supports use of the Beers Criteria, which are based solely on consensus guidelines and expert opinions.

Limited evidence suggests that inappropriate prescribing and polypharmacy can be reduced by up to 24% using pharmacists' recommendations based on review of patients' charts and medications lists. This method of intervention may also reduce adverse drug events by 25% without adversely affecting health related quality of life.

Though research has shown that physicians welcome pharmacists' recommendations, further study is needed to look at ways in which physicians and pharmacists may work together effectively to decrease inappropriate prescribing in the elderly. In addition, since the studies reviewed were conducted before the implementation of Medicare Part D and its change in pharmacy scope of practice, further study is needed to help define this new role of the pharmacist.

The studies reviewed also show that serious medication errors can be decreased by 55% and adverse drug events by 84% when physicians use computerized alerts in the inpatient setting. Considering the significance of hospital safety and quality care issues, this method provides an avenue for hospitals to decrease inappropriate prescribing in elderly hospitalized patients. However, for computerized alerts to work in the inpatient setting, the physician should have access to all pertinent patient information to make an adequate decision. Further study is also needed to determine why physicians routinely bypass or override computerized alerts.

In addition, inappropriate prescribing and polypharmacy can be reduced when a multidisciplinary team consisting of a consulting pharmacist, physician, and nurse reviews a patient's medications through a "brown bag" review including nonpre-

scription substances such as vitamins and herbal products. This method of intervention will not only decrease the number of medications used by older patients but also medication costs. Further study is needed to see if similar results are achieved in Geriatric Assessment Clinics and also by using the patient's primary care physician versus a comprehensive team approach for medication review.

Reducing inappropriate prescribing in the elderly can also be achieved through a simple patient educational intervention such as a single letter recommending medications be reduced. Patient education through an outpatient evaluation and management program consisting of regular assessments and medication review protocols can reduce serious adverse drug events by 35%.

The Beers Criteria have been widely used for well over 10 years and have been adopted by the Centers for Medicare and Medicaid Services for nursing home regulation. They are, however, based on a US Consensus Panel of experts using a modified Delphi Method rather than on any research evidence. The Beers Criteria may be helpful solely as a guide in assisting the practitioner to determine whether or not a certain medication may be considered inappropriate for use in the older patient. However, further evidence-based research is needed to determine which medications are considered inappropriate for use in the older adult.

Limitations

This systematic review has several limitations. First, there are few randomized controlled trials that address inappropriate prescribing in patients 65 years of age and older, thus, limiting the strength of evidence. Secondly, the majority of studies reviewed involved healthy elderly and not ill elderly; thus, recommendations for reducing inappropriate prescribing in the elderly may not apply to ill elderly. Finally, the systematic review involved studies prior to Medicare Part D and thus do not take into account the provision of management programs

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Computerized alerts in an inpatient setting have reduced medication errors by 55%

under Medicare Part D. With the changing scope of pharmacy practice that Medicare Part D brings, further study will be needed to define the role of the pharmacist in prevention of medication errors. ■

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A medication grid is a helpful visual reminder of patients' regimens