Inappropriate Medication Prescribing for Elderly Ambulatory Care Patients

Margie Rauch Goulding, PhD

Background: Inappropriate medication use in elderly patients has been linked to a large share of adverse drug reactions and to excess health care utilization.

Methods: Trends in the prevalence of potentially inappropriate drug prescribing at ambulatory care visits by elderly persons from 1995 to 2000 were examined with data from office-based physicians in the National Ambulatory Medical Care Survey and from hospital outpatient departments in the National Hospital Ambulatory Medical Care Survey. Explicit criteria were used to identify potentially inappropriate prescribing. Multivariate regression was used to identify related factors.

Results: In 1995 and 2000, at least 1 drug considered inappropriate by the Beers expert panel was prescribed at 7.8% of ambulatory care visits by elderly patients. At least 1 drug classified as never or rarely appropriate by the Zhan expert panel was prescribed at 3.7% and 3.8% of these visits in 1995 and 2000, respectively. Pain relievers and central nervous system drugs were a large share of the problem. The odds of potentially inappropriate prescribing were higher for visits with multiple drugs and double for female visits. The latter was due to more prescribing of potentially inappropriate pain relievers and central nervous system drugs.

Conclusions: Potentially inappropriate prescribing at ambulatory care visits by elderly patients, particularly women, remains a substantial problem. Interventions could target more appropriate drug selection by physicians when prescribing pain relievers, antianxiety agents, sedatives, and antidepressants to elderly patients. Such behavior could eliminate a large portion of inappropriate prescribing for elderly patients and reduce its higher risk for women.

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Although appropriate drug therapy can prevent morbidity, the use of inappropriate drugs can harm patients. Inappropriate medication use in elderly (age ≥65 years) patients has been linked to a large share of adverse drug reactions, to worse physical function, and to excess health care utilization. Therefore, the use of inappropriate medications by elderly patients is an important concern for patient safety and rational use of health care resources.

Prior studies of inappropriate drug prescribing for elderly persons have used explicit criteria developed by panels of experts in geriatric medicine and pharmacology, led by Mark Beers, MD. The panels reviewed summary statements constructed from published literature on the ineffectiveness of specific drugs and/or their risk of adverse effects for elderly persons. The drugs that the panel members agreed on as having a risk of adverse effects outweighing the potential benefits became the published criteria. The original Beers criteria were agreed on for elderly nursing home residents. The updated (1997) Beers criteria were developed for all elderly patients. Beers wrote “...some people prefer to say that such criteria define potential inappropriate prescribing rather than actual inappropriate prescribing.” For the sake of simplicity, in this article I refer to the drugs on the “Beers list” as inappropriate rather than potentially inappropriate.) The validity of the Beers criteria comes from the combination of the published evidence on each drug, the clinical experience of the panel members, and 2 outcomes studies.

In 2000, an expert panel organized by Chunliu Zhan, MD, PhD, further categorized the 1997 Beers list of drugs as drugs that should always be avoided, were rarely appropriate, or had some indications for use in elderly patients but were often misused. The Zhan criteria were published in December 2001, and, to my knowledge, no outcomes study using these criteria has been published to date.

The most recent national estimates of inappropriate drug prescribing or inappropriate drug use among elderly patients in the United States were done with 1997 survey data of physician office vis-

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appropriate prescribing.10 A study of new nursing home providers, and certain drug classes to be associated with prescribed medicines, as well as nonmetropolitan area providers in the United States also found a higher number of prescribed medicines.3 However, in US studies of noninstitutionalized elderly patients, there has been little examination of the relationship of physician factors to inappropriate prescribing.

The present study applies the 1997 Beers criteria and the drugs classified as never or rarely appropriate by the Zhan panel6 to examine trends in the prevalence of inappropriate prescribing at ambulatory care visits by elderly persons from 1995 to 2000. Data from hospital outpatient department visits as well as physician office visits are used to give a more complete picture of inappropriate prescribing at ambulatory care visits. Important benefits of using data from medical providers are (1) the expected higher accuracy of the drug name data over that reported by elderly patients12,13 and (2) the availability of some information on the medical provider. This study examines the relationship of patient, visit, and physician characteristics, including physician's age and specialty, with inappropriate prescribing. It also further explores the higher risk of inappropriate prescribing found for female patients.

METHODS

DATA SOURCES

Data were obtained from 2 surveys, the National Ambulatory Medical Care Survey (NAMCS) and the National Hospital Ambulatory Medical Care Survey (NHAMCS). The NAMCS is an annual national cross-sectional survey of physicians that collects information on medical visits in physician office settings.14 The sampling frame for the NAMCS is all office-based, nonfederally employed physicians listed in the American Osteopathic and American Medical Association’s files. Physicians not principally engaged in patient care or working in anesthesiology, pathology, or radiology are excluded. Sampled physicians are randomly assigned a week in the survey year, and a random sample of visits during that week is selected. In most cases, the physician or a staff member completes the information requested for each patient visit. The response rate fell from 73% in 1995 to 63% in 1999 and went back up to 68% in 2000.14,16

The NHAMCS, which is also an annual cross-sectional survey, collects patient visit data from health care providers for medical visits in hospital outpatient and emergency departments.17 The present study used only the hospital outpatient department visit data, since outpatient departments represent an alternative site for care that is similar to that provided in physician offices, while emergency departments provide a different level of care. The sampling frame for the NHAMCS is general and short-stay hospitals in the United States, excluding federal, military, and Veterans Affairs hospitals. Data are collected by trained hospital staff for a sample of patient visits occurring in a randomly assigned 4-week period. From 1995 to 2000, the hospital response rate was in the 94% to 98% range.17,22

Data from 1995 to 2000 were selected because 2000 was the most recent year of available data, and 1995 was the first year in which up to 6 medications per visit were recorded. Previously, only up to 5 medications per visit were recorded.

INAPPROPRIATE PRESCRIBING

Inappropriate prescribing was indicated at a visit by the report of any of 38 drugs or drug groups that an expert panel, led by Beers, concluded should generally be avoided in patients older than 65 years, regardless of drug dosage or medical diagnosis (hereafter, Beers list [BL] (Table 1). Drugs that are inappropriate by the Beers criteria only at certain dosages were not included in the BL inappropriate prescribing measure because the NAMCS and NHAMCS do not collect dosage information. Drugs considered inappropriate only if the patient has a certain medical condition also were not included, since only 3 diagnosis codes per visit are collected and the condition of interest might have been present but not recorded.

While the BL is a well-known and frequently used measure, several of its drugs have more than 1 clinical indication, and the risk-benefit ratio can differ by use. Taking this into account, an expert panel, organized by Dr Zhan in 2000, catego-

ized the BL drugs by appropriateness. The 19 drugs or drug groups that the Zhan panel classified as “always avoid” or “rarely appropriate” (hereafter, “Zhan list” [ZL]) (Table 1) were used as a second measure of inappropriate prescribing.

For each visit, up to 6 prescription or nonprescription medications prescribed, administered, injected, or provided at the visit or prescribed or provided at a prior visit that the patient is expected to continue taking were recorded. The nonprescription drugs were excluded from the analysis. The medications’ generic drug ingredients are coded in the visit data.14,17 This allowed easy identification of the inappropriate drugs.

PATIENT, PROVIDER, AND VISIT CHARACTERISTICS

Patient characteristics included sex, age, race, and whether the patient was a member of a health maintenance organization (HMO). Patient diagnoses were not included as analytic variables, since the information could be incomplete for sickly, elderly patients given both surveys’ reporting limit of 3 diagnosis codes per visit. Visit characteristics included visit site (physician office or hospital outpatient department), if the patient was referred by another physician for that visit, and the number of prescription drugs reported for the visit. Medical provider characteristics included physician age, physician specialty (ie, family/general practice, internal medicine, and all other specialties), whether the visit was with the patient’s primary care physician, and location of the physician’s office or the hospital outpatient department (ie, region of the United States and in or outside a metropolitan area).

STATISTICAL APPROACH

The unit of analysis was the visit. Estimates and their standard errors were calculated using SUDAAN software (SUDAAN, Research Triangle Park, NC) to adjust for the complex multistage sampling design of the NAMCS and NHAMCS surveys. Weighted data were used in all analyses. Prevalence estimates for inappropriate prescribing at elderly person ambulatory care visits were done with both the BL and ZL. To examine the re-
relationships of patient, provider, and visit characteristics with inappropriate drug prescribing, SUDAAN was used to perform \( \chi^2 \) tests and multivariate logistic regression (with a .05 cutoff for statistical significance).

The multivariate modeling was done in steps. First, patient, provider, and visit characteristics, including prescription drug count, were examined using the elderly person ambulatory care visits with report of at least 1 prescription drug. The physician office visits and hospital outpatient department visits for 1999 and 2000 were combined to provide information covering the 2 types of ambulatory care settings and to increase the sample size. Next, the physician office visits data were analyzed separately because physician age and specialty information were available only in those data. The patient, provider, and visit characteristics, including drug count but excluding primary care physician status, were examined using the physician office visits of elderly persons with report of at least 1 prescription drug. The primary care physician variable was excluded from the regression model that included the physician specialty variable because the 2 variables were correlated (Spearman rank correlation coefficient = 0.66). The models were run with both sets of criteria (the BL and ZL).

Since the BL inappropriate prescribing prevalence rate for 1999 physician office visits (but not hospital outpatient department visits) by elderly persons was significantly lower than the estimates for 1998 and 2000 and the 1999 NAMCS had a lower response rate and resulting number of sample visits, consideration was given to using the 1998 and 2000 data in the multivariate regression analysis instead of the 1999 and 2000 data. However, the regression analyses with both sets of data yielded almost identical lists of significant variables with similar odds ratios. Therefore, the 1999-2000 results are considered reliable and are reported in the next section.

## RESULTS

### CHARACTERISTICS OF AMBULATORY CARE VISITS BY ELDERLY PATIENTS

The majority of visits by elderly patients to physician offices and hospital outpatient departments in 1999 and 2000 combined were by women and white persons were to providers in metropolitan areas. The majority of physician office visits by elderly patients in 1999-2000 were to physicians with a specialty other than internal medicine. No prescription drugs were reported for 31% of the 1999-2000 combined physician office and hospital outpatient department visits by elderly patients.

### Table 1. 1997 Beers List of Potentially Inappropriate Drugs for Elderly Persons (With Zhan Appropriateness Classification)*

<table>
<thead>
<tr>
<th>Cardiovascular-renal drugs</th>
<th>Antihypertensive agents or ( \omega )-agonist/( \omega )-blockers</th>
<th>Disopyramide SI</th>
<th>Reserpine SI</th>
<th>Methyldopa SI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary vasodilators or cerebral/peripheral vascular disorder drugs</td>
<td>Cyclandelate NC</td>
<td>Ergot mesylates NC</td>
<td>Urinary tract relaxants/stimulants</td>
<td>Oxybutynin SI</td>
</tr>
<tr>
<td>Central nervous system agents</td>
<td>Sedative/hypnotic agents</td>
<td>Butalbital†</td>
<td>Flurazepam AA</td>
<td>Antianxiety agents</td>
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<td></td>
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<td>Chloralhydrate oxalate RA</td>
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<td>Diazepam RA</td>
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<td></td>
<td>Meprobamate AA</td>
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<td></td>
<td>Antidepressants</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Amitriptyline‡ SI</td>
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<tr>
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<td></td>
<td>Doxepin SI</td>
</tr>
<tr>
<td>Gastrointestinal agents</td>
<td>Acid/peptic disorders</td>
<td>Belladonna alkaloids AA</td>
<td>Propantheline AA</td>
<td>Antidiarrheal agents</td>
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<td></td>
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<td></td>
<td>Dicyclomine AA</td>
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<td></td>
<td>Antispasmodics/anticholinergics</td>
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<td>Cidinium-chlordiazepoxide RA</td>
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<td></td>
<td>Hyoscyamine AA</td>
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<td></td>
<td>Hematologic agents</td>
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<td></td>
<td>Anticoagulants</td>
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<td></td>
<td></td>
<td>Dipyridamole SI</td>
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<td></td>
<td></td>
<td>Ticlopidine SI</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Respiratory tract</td>
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<td></td>
<td></td>
<td>Antihistamines</td>
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<td></td>
<td>Relief of pain</td>
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<td></td>
<td></td>
<td>Analgesics</td>
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<td></td>
<td></td>
<td>CNS stimulants</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Urinary tract relaxants/stimulants</td>
</tr>
</tbody>
</table>

**Abbreviations:** AA, always avoid; NC, not classified; RA, rarely appropriate; SI, some indications.

*Organized by National Drug Code drug class, subclass, individual drugs (single or combination medications with these drugs [except cindinium alone] counted as potentially inappropriate), and Zhan appropriateness classification.

†Butalbital, pentobarbital, and secobarbital.

‡Including amitriptyline with chloridrazepoxide and amitriptyline with perphenazine.

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hospital outpatient department visits, while 3 or more drugs were reported for almost 32% of these visits.

For elderly patient visits to physician offices, the prevalence of inappropriate drug prescribing, using the Beers criteria, was similar in 1995 (7.62% of visits), 1996 (7.63%), 1998 (7.63%), and 2000 (7.82%) (Table 3). For visits of elderly patients to hospital outpatient departments, there was a steady but not statistically significant decline in the prevalence of inappropriate prescribing from 9.86% of visits in 1995 to 7.21% in 2000. The annual estimates (1995-2000) of inappropriate prescribing at physician office visits were not significantly different from those for hospital outpatient department visits. More than 90% of the combined physician office and hospital outpatient department visits by elderly patients took place at physician offices. For these combined visits, the prevalence of BL inappropriate prescribing was similar in 1995 (7.76%) and 2000 (7.78%). The prevalence estimates with the ZL inappropriate prescribing measure, while lower, also do not decline from 1995 (3.69%) to 2000 (3.83%).

A small number of drugs are a large and clinically significant share of the problem. The 5 BL inappropriate drugs with the highest prescribing frequency at elderly patient ambulatory care visits in 2000 were the pain reliever propoxyphene (1.5% of visits), the antihistamine hydroxyzine (1.1% of visits), the antianxiety agent diazepam (0.7% of visits), the antidepressant amitriptyline (0.7% of visits), and the urinary tract relaxant oxybutynin (0.7% of visits). One or more of these 5 drugs was reported at 58% of the elderly patient visits with prescription of any BL drugs in 2000. In addition, diazepam and amitriptyline are considered by the Beers panel to have a high likelihood of having a severe adverse outcome in elderly patients.3

When I looked at inappropriate prescribing by National Drug Code Directory drug class,23 a few classes represented a large share of the problem. In the year 2000, almost half of the elderly patients visits with prescription of BL drugs involved inappropriate pain relievers or inappropriate drugs in 3 subclasses of central nervous system (CNS) drugs (antidepressants, antianxiety agents, and sedative/hypnotics). Almost three quarters of the year 2000 elderly patient visits with prescription of ZL drugs involved inappropriate pain relievers or inappropriate drugs in the 3 CNS drug subclasses.

### CORRELATES OF INAPPROPRIATE DRUG PRESCRIBING

In analyses of elderly patient visits in 1999-2000 with report of at least 1 prescription drug, patient sex, patient age, and the number of prescription drugs reported for the visit were associated with BL inappropriate prescribing, controlling for patient, provider, and visit characteristics. The odds of inappropriate prescribing were almost double for visits by elderly women compared with visits by elderly men (odds ratio [OR] = 1.96) and lower for visits by patients 80 years and older compared with patients aged 65 to 69 years (OR=0.66) (data not shown). The odds of inappropriate prescribing rose with each additional prescription drug (OR=2.65 for 2 drugs compared with 1, 3.08 for 3 drugs, 3.35 for 4 drugs, 4.15 for 5 drugs, and 6.37 for 6 drugs). In
addition, for visits with missing information on the patient's HMO status, there was a higher risk of inappropriate prescribing compared with the visits by patients known not to be an HMO enrollee (OR = 1.35). However, the risk was not significantly higher for visits by patients known to be HMO enrollees. Visit site, provider region, metropolitan location, patient's primary care physician, race, and referral status were not associated with inappropriate prescribing.

To more closely examine the influence of sex, interactions between sex and the two other highly significant variables (patient age group and number of prescription drugs) were tested in the multivariate regression models; however, none showed significant interaction for the risk of inappropriate prescribing. Examining the prescriptions by drug class, more visits by elderly women than by elderly men in 1999-2000 involved BL inappropriate pain relievers (2.1% vs 1.1%; P < .001) and BL inappropriate CNS drugs (1.9% vs 1.3%; P = .03) (data not shown). For the inappropriate CNS drugs, this difference resulted from a higher proportion of visits by elderly women than by elderly men involving prescriptions for drugs in the 3 CNS drug subclasses (antidepressant, antianxiety, or sedative/hypnotic) that the inappropriate drugs are in (10.3% vs 7.0%; P < .001). Although the proportion of visits with any pain relievers prescribed was not significantly different for visits by elderly women and men (18.9% vs 18.7%; P = .79), for visits in which a pain reliever was prescribed, the proportion with an inappropriate pain reliever was higher for elderly female than for elderly male visits (10.8% vs 5.9%; P < .001).

Physician age was not associated with BL inappropriate prescribing at physician office visits by elderly persons with report of a prescription drug, controlling for other patient, provider, and visit characteristics including a count of the drugs prescribed (Table 4, the ZL results). The OR for inappropriate prescribing at visits to physicians 60 years and older compared with physicians aged 40 to 59 years was 1.29, but the lower bound of the 95% confidence interval was just below 1. Higher odds of inappropriate prescribing were found in visits to family and general practitioners compared with specialists other than internal medicine physicians (OR = 1.41).

Using the ZL, I found again that visits involving female patients and more medications were associated with a higher risk of inappropriate prescribing, while older patient age was associated with a lower risk in models of all elderly patient ambulatory care visits with drug reports (data not shown) and only those visits at physician offices (Table 4, the ZL results). However, the higher odds of inappropriate prescribing for visits to general and family practitioners did not reach statistical significance (OR = 1.40; 95% confidence interval, 0.87-2.24).

### Table 3. Proportion of Elderly Person Ambulatory Care Visits With Potentially Inappropriate Drugs Prescribed (1995-2000)

<table>
<thead>
<tr>
<th>Year</th>
<th>Physician Office Visits With Prescription of a Beers List Drug, Weighted (SE)</th>
<th>Hospital Outpatient Visits With Prescription of a Beers List Drug, Weighted (SE)</th>
<th>Total Visits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Category</td>
<td>Weighted (SE)</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>7.82 (0.61)</td>
<td>7.21 (0.69)</td>
<td>7.78 (0.57)</td>
</tr>
<tr>
<td>1996</td>
<td>7.63 (0.61)</td>
<td>7.33 (1.00)</td>
<td>6.09 (0.47)</td>
</tr>
<tr>
<td>1997</td>
<td>7.63 (0.59)</td>
<td>7.58 (0.98)</td>
<td>7.63 (0.56)</td>
</tr>
<tr>
<td>1998</td>
<td>6.01 (0.51)</td>
<td>7.33 (1.00)</td>
<td>6.09 (0.47)</td>
</tr>
<tr>
<td>2000</td>
<td>7.63 (0.45)</td>
<td>7.21 (0.69)</td>
<td>7.78 (0.57)</td>
</tr>
</tbody>
</table>

These figures summed may not match the estimate with the Beers list because (1) a visit with multiple drugs may be counted in more than 1 of the Zhan panel’s drug appropriateness categories and (2) 5 drugs on the Beers list were not classified in the Zhan panel’s drug appropriateness categories.

### Comment

Inappropriate drug prescribing at physician office visits or hospital outpatient department visits for community-dwelling elderly persons in the United States is a well-documented problem. Nevertheless, the present study contributes information on the trend in inappropriate prescribing, a recent estimate of the number of ambulatory care visits involved, as well as additional evidence on the risk for women, the risk with prescribing by general and family practitioners, and the risks with the prescribing of pain relievers and 3 subclasses of CNS drugs.

In 1995 and 2000, the prevalence of inappropriate drug prescribing at ambulatory care visits by persons 65 and older was approximately 7.8% by the BL and 3.7% to 3.8% by the ZL. These figures cannot be translated into a proportion of elderly patients with inappropriate prescribing because (1) prescribing at a visit to 1 physician likely does not cover all the drugs a patient is prescribed by all of his or her physicians and (2) the same patient may be counted in the visit data more than once. Nevertheless, these estimates are evidence that inappropriate prescribing to elderly patients at ambulatory care visits did not improve from 1995 to 2000.
the need for greater attention to appropriate prescribing and sup-
or disease-contraindicated drugs. These findings suggest the
dosage or the potential for harmful drug-drug interaction
ervative. Neither measure includes drugs with an excessive
with the shorter ZL. Moreover, these estimates are conser-
appropriate drug. This estimate is still sizable: 8.2 million visits
in physician offices or hospital outpatient departments in the year
*Abbreviation: HMO, health maintenance organization.

Table 4. Adjusted Odds of Potentially Inappropriate
Drug Prescribing by Patient, Provider, and
Visit Characteristics at Elderly Person
With Prescription Drug Reports (n = 8139) *

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Beers List</th>
<th>Zhan List</th>
</tr>
</thead>
</table>
| Patient char.

Moreover, inappropriate prescribing remains a substan-
tial problem. At an estimated 16.7 million visits to physi-
cian offices or hospital outpatient departments in the year
2000, elderly patients were prescribed at least 1 BL inappropriate
drug. This estimate is still sizable: 8.2 million visits with the shorter ZL. Moreover, these estimates are conserva-
neither measure includes drugs with an excessive dosage or the potential for harmful drug-drug interaction
disease-contraindicated drugs. These findings suggest the
need for greater attention to appropriate prescribing and sup-
portive interventions in ambulatory care.

Three drugs are a large and persistent part of the prob-
lem. Three of the most prescribed BL inappropriate drugs
at elderly patient visits in 2000 (ie, the pain reliever pro-
opxyphene, the antidepressant amitriptyline, and the an-
tianxiety agent diazepam) also were found in earlier stud-
ies to be among the most prescribed inappropriate
drugs.\textsuperscript{10,24,25,31} Partly because of the high prevalence of these
3 drugs, large shares of the BL and ZL inappropriate pre-
scribing were for drugs in the pain reliever and CNS drug
classes. In addition, these drug classes had high rates of in-
appropriate prescribing. At elderly patient visits with pre-
scription of any antianxiety, sedative/hypnotic, or antide-
presossant CNS drugs in 1999-2000, 15.2\% involved BL in-
appropriate CNS drugs compared with 10.1\% that involved
BL drugs among elderly patient visits with any prescription
drugs. For elderly patient visits with any pain relievers
prescribed, 8.8\% involved BL pain relievers. The proportions
were nominally lower for the anticoagulant drug group
(8.1\%) and substantially lower for the gastrointestinal drug
group (5.8\%).

These findings raise questions about why physicians
more frequently choose inappropriate drugs in 3 of the CNS
drug subclasses (antidepressants, antianxiety agents, and
sedatives/hypnotics) and the pain reliever drug class. While
it is true that there are several inappropriate drugs in these
classes, there are also appropriate alternatives for elderly
persons (eg, acetaminophen for pain and medium- or short-
acting benzodiazepines for anxiety\textsuperscript{5}). One possibility is that
physicians are used to prescribing the older drugs and in-
appropriate drugs in these classes and may not be aware
of their risks. Older drugs tend to be less expensive and
cost may be a factor in drug selection. Patient demand also
may play a role. Some of the analgesics (eg, propoxy-
phene napsylate and propoxyphene hydrochloride) and an-
tianxiety agents (eg, diazepam) can be addicting.\textsuperscript{32} This sug-

Elderly female patients were at greater risk of inappro-
priate prescribing at ambulatory care visits than were elde-
ry male patients even after controlling for higher prescrib-
ing at women’s visits. This relationship held for 1998, 1999,
and 2000 but not 1997 with the Beers criteria and for all 4
years with the Zhan criteria (data not shown). A study based
on 1996 Medical Expenditure Panel Survey data also found
elderly women to be at higher risk than elderly men.\textsuperscript{6}

The higher risk of inappropriate prescribing at visits
by elderly women, even after controlling for the number of
drugs prescribed, appears to stem from the type of drugs
prescribed. More visits by elderly women compared with
elderly men involved inappropriate CNS drugs and inap-
propriate pain relievers. The proportion of visits involving
any drugs from 3 CNS subclasses (antidepressant, an-
tianxiety, and sedative/hypnotic drugs) also was higher for
visits by women than by men. Studies show that women
are prescribed and use more psychotropic medications con-
pared with men.\textsuperscript{33-36} This analysis also found that among
these visits with pain relievers prescribed, women’s visits
were more likely than men’s to involve inappropriate pain
reliers. These results suggest the potential value of tar-
getting female patients and/or targeting antidepressants, an-

tianxiety agents, sedatives/hypnotics, and pain relievers with interventions to improve prescribing.

This study’s results add to the limited evidence, mostly from nursing home studies, on the relationship of physician specialty to inappropriate prescribing for elderly patients.11,37,38 With the BL, a higher risk of inappropriate prescribing was found for visits to general and family practitioners compared with visits to specialists other than internal medicine physicians. The higher risk may be due, at least partly, to the more frequent prescribing of pain relievers and 3 subclasses of CNS drugs at visits to general and family practitioners compared with visits to specialists, which in turn may be related to differences in the mix of health conditions treated by these providers. Two Canadian studies found a positive association between family and general practitioners and inappropriate prescribing.12,38 With the shorter ZL as the criteria, the higher risk at visits to general and family practitioners did not reach statistical significance. Further study is warranted to confirm the strength and cause of this relationship.

Another issue raised by the 1999-2000 results is the appearance of a protective effect against inappropriate prescribing, with both the Beers and Zhan criteria, for patients 80 years and older. Examination of single years of data on ambulatory care visits with drug reports shows, with the BL, a significantly lower risk for this age group only in 2000 and not in 1997, 1998, or 1999 and not in all 4 years with the ZL. Either this protective relationship was not present in prior years or was not strong enough to manifest itself in single years of data.

Finally, this study provided additional evidence on the relationships of patient race and HMO membership to inappropriate prescribing. A prior study found a lower rate of inappropriate prescribing to elderly members of a New York HMO compared with 2 national samples of largely non-HMO elderly people.27 In addition, 3 studies showed lower use of appropriate therapies—thrombolytics39 and β-blocker drugs40,41—for black compared with white patients, and 2 studies of community-dwelling elderly had conflicting results on the relationship of race to inappropriate prescribing.11,38 With the shorter ZL as the criteria, the higher risk at visits to general and family practitioners did not reach statistical significance. Further study is warranted to confirm the strength and cause of this relationship.

In conclusion, more comprehensive drug and diagnosis data to gauge the true magnitude of inappropriate prescribing are needed. Even with the narrow measures used, this study showed no improvement in a large and important patient safety problem—the prescribing of potentially inappropriate drugs at 8.2 million to 16.7 million elderly patient ambulatory care visits in 2000. This suggests the need to target ambulatory care for improvement in prescribing to elderly patients.

A limitation of the criteria is that the small number of outcome studies for elderly persons using BL drugs provided mixed evidence of harm. A study of patients at an emergency department found that the 3-month outcomes included worse pain and physical function for elderly persons prescribed inappropriate drugs before or at the emergency department visit.2 Another study found higher outpatient, emergency department, and inpatient use for elderly patients taking BL drugs.3 However, the emergency department study did not find higher rates of revisit to the emergency department, hospitalization, or death for elderly emergency department visitors using inappropriate drugs.2 A third study, with a 3-year follow-up, did not find increased mortality or reduced functioning for community-dwelling elderly using BL drugs.42 Finally, a study of elderly nursing home residents in the United States found that certain patterns of exposure to inappropriate drugs were associated with higher risk of subsequent hospitalization and death.43 It may be that for community-dwelling elderly the measureable harms associated with the use of BL inappropriate drugs are a worsening of symptoms such as pain and a short-term decline in functioning, which primarily lead to increased physician visits. It is less clear that use of the BL drugs by community-dwelling elderly has longer-term and more severe adverse effects. However, for the frailer, more disabled geriatric nursing home population the adverse effects of inappropriate drugs may be more severe. Additional studies with both short- and long-term health, functioning, and health care utilization measures for both populations are warranted.
There is a sizeable body of literature on the effectiveness of various interventions to improve physician prescribing, albeit the cost-effectiveness of these approaches has not been adequately evaluated.44–47 Two groups for which interventions could be targeted are the more likely prescribers of inappropriate drugs (i.e., family and general practitioners) and the more likely recipients of inappropriate drugs (i.e., patients taking several medications, patients prescribed pain relievers or CNS drugs, and women). In particular, more appropriate drug selection when prescribing pain relievers, antianxiety agents, sedatives/hypnotics, and antidepressants to elderly patients could eliminate a large portion of inappropriate prescribing and reduce its higher risk for women.

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